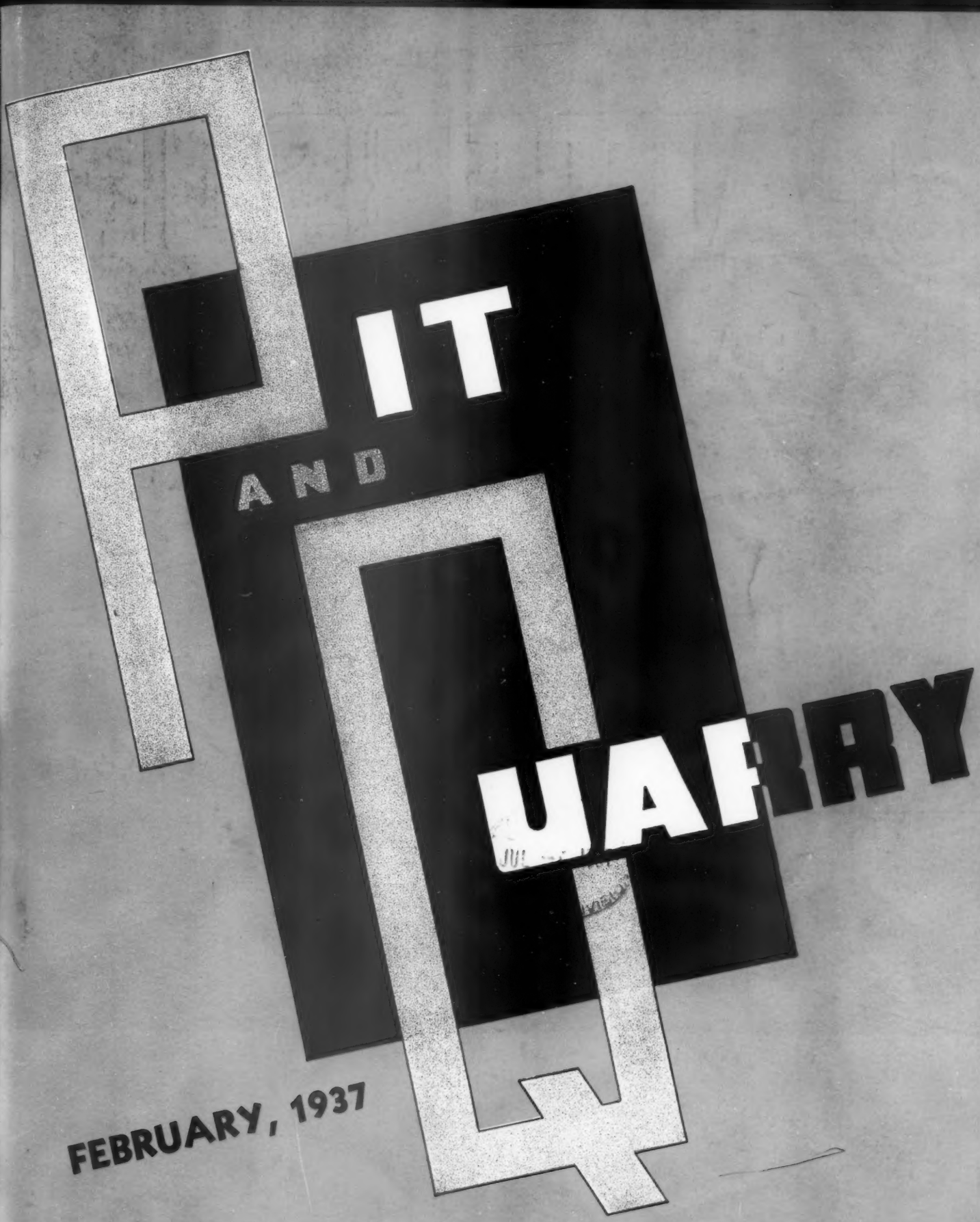
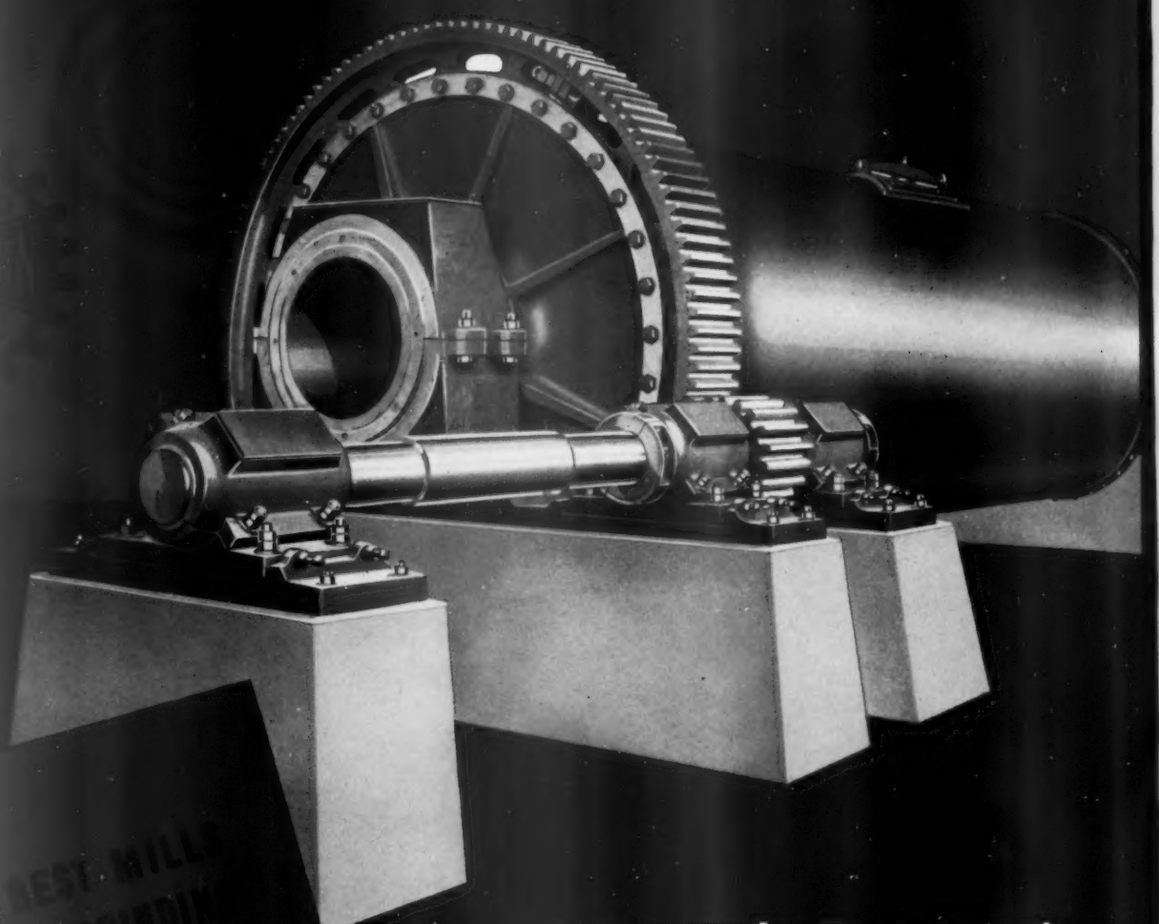


FEBRUARY, 1937

Crushed Stone Assn. Convention at Cincinnati . . . Damaged Crusher Head Replaced with Welded Plates . . . What Congress Is Proposing . . . Concrete Industry Meets at Chicago

PATTERSON

BALL *and* TUBE MILLS



Rugged — True Running
Efficient . . .

There is a Patterson Mill ideally suited to your service—whatever your requirements may be.

Richard L. Cawood
PRESIDENT

THE PATTERSON FOUNDRY and MACHINE CO.
EAST LIVERPOOL, OHIO, U. S. A.

Receives four times more Service from

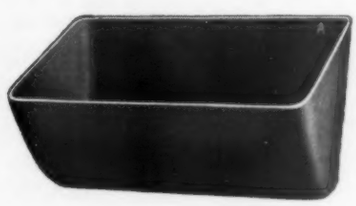
LINK-BELT *Promal* CHAIN

● This bucket elevator handles hot Fullers earth at the plant of the Fullers Earth Co., Midway, Fla. The service is extremely severe, the material being very abrasive. The No. 710 malleable chain, with which it was formerly equipped, usually had to be replaced about every 12 months.

In 1931 the elevator was equipped with Link-Belt Promal chain. Now, after over five years' service, an inspection showed little wear. The

indications are that this Promal chain will last at least another year.

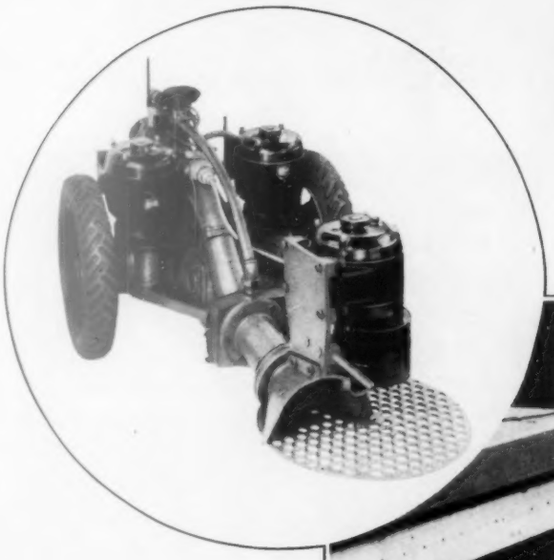
For real economy, long life and dependability, try Link-Belt Promal chain and buckets on your severe service conveyors and elevators. Send



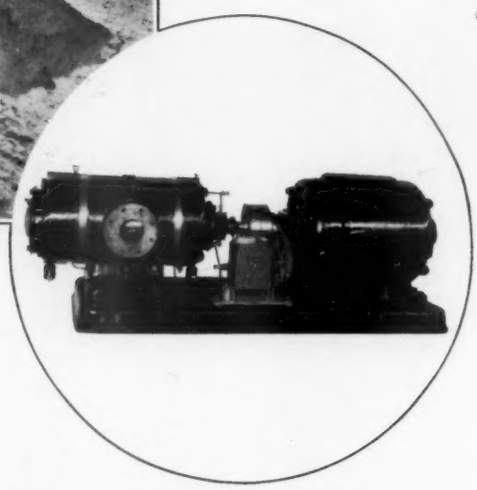
for Promal Chain Book No. 1050-A. Address Link-Belt Company, Indianapolis, Chicago, Philadelphia, Atlanta, San Francisco, or Toronto. Offices located in principal cities. 5834

PIT AND QUARRY, February, 1937. Vol. 29, No. 7. Published monthly by the Complete Service Publishing Company, 538 South Clark Street, Chicago, Ill. Subscription price: $2 for 3 years, $1 for 1 year in the U. S. and possessions, Canada and Central and South America; elsewhere $1 additional for each year. Single copies 20 cents. Entered as second-class matter November 28, 1932, at the Post-Office at Chicago, Ill., under the Act of March 3, 1879.

UNDIVIDED RESPONSIBILITY AT PEORIA



FULLER-KINYON UNLOADER
AND
FULLER ROTARY COMPRESSOR



All of the cement used in the construction of the Peoria Lock in the Illinois River (Great Lakes Dredge and Dock Co., contractors) is being handled by a Fuller-Kinyon Automatic Remote-Control Unloader, and the air for this Unloader is being supplied by a Fuller Rotary Compressor . . . equipment built by one manufacturer and sold under one contract . . . no division of responsibility for the satisfactory performance of the unit as a whole.

This represents an ideal installation . . . the most efficient and economical method for unloading and conveying Portland cement and many other pulverized materials.

Cement on this project is unloaded from barges, and conveyed to the mixing plant, *a distance of 413 feet.* The Unloader has a capacity of 115 barrels per hour through a 4" pipe line, and the Fuller Rotary Compressor supplies the necessary quantity of air at a required maximum of 35 lb. pressure.

We shall be glad to send you bulletins on both the Fuller-Kinyon Automatic Remote-Control Unloader, and the Fuller Rotary Compressor.

FULLER COMPANY

CATASAUQUA, PENNSYLVANIA

Chicago: 1118 Marquette Bldg.
San Francisco: 320-321 Chancery Bldg.

P-16

FULLER-KINYON, FLUXO, AND AIRVEYOR CONVEYING SYSTEMS · · · ROTARY FEEDERS AND DISCHARGE GATES
ROTARY AIR COMPRESSORS AND VACUUM PUMPS · · · AUTOMATIC BATCH WEIGHERS · · · BIN SIGNALS

Photo shows a "600" Page Walker (128' boom 3½-cy bucket) stripping gypsum at National City, Michigan.

High Yardage WALKING DRAGLINE

for COAL STRIPPING • LEVEE BUILDING GENERAL EXCAVATION • RECLAMATION WORK PLACER MINING

The PAGE Walker Series "600" Diesel Powered—Moderately Priced (3 to 5-cu. yd. machines immediately available).

A completely modern, rugged, dragline machine with high load, hoist, and swing speeds for greater yardage 24 hours per day, month after month.

PLUS—A large circular base and a simple positive crank-action walking mechanism which permits working on the softest ground—guarantees immediate movability in any direction.

If your work requires more yardage—lower operating cost—longer reach—complete independence of weather conditions—learn all about the Page Walker Series "600."

Page Engineering Co.

Clearing Post Office • • Chicago, Ill.

PAGE AUTOMATIC DRAGLINE BUCKETS
PAGE WALKING DRAGLINE MACHINES
PAGE DIESEL ENGINES

PAGE ENGINEERING COMPANY
CLEARING POST OFFICE CHICAGO, ILLINOIS

Please send information on a Page "600" Walker. Size _____

Name _____

Address _____

City _____ *State* _____ "F"

Cut YOUR ROCK DRILLING COSTS IN 1937 WITH

TIMKEN ROCK BITS

Every hole your drillers put down this year can be made to yield a substantial saving through the use of TIMKEN Bits. Included in TIMKEN Rock Bit economies are (1) elimination of forging; (2) radical reduction in nipping costs; (3) greatly curtailed steel investment; (4) faster drilling; (5) increased footage yield per bit.

Wherever TIMKEN Bits have been given a thorough test against forged steel or other bits they have opened the eyes of drillers, who have been quick to realize their possibilities and take advantage of them.

Try them on your next job in comparison with the steel or bits you are now using, keeping an accurate record of their savings, and we are confident you will see the advisability of adopting them exclusively.

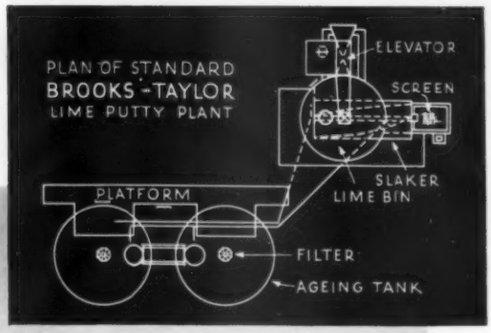
THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

TIMKEN

TRADE MARK REG. U. S. PAT. OFF.

The BROOKS-TAYLOR Method of Producing *Aged Lime Putty*



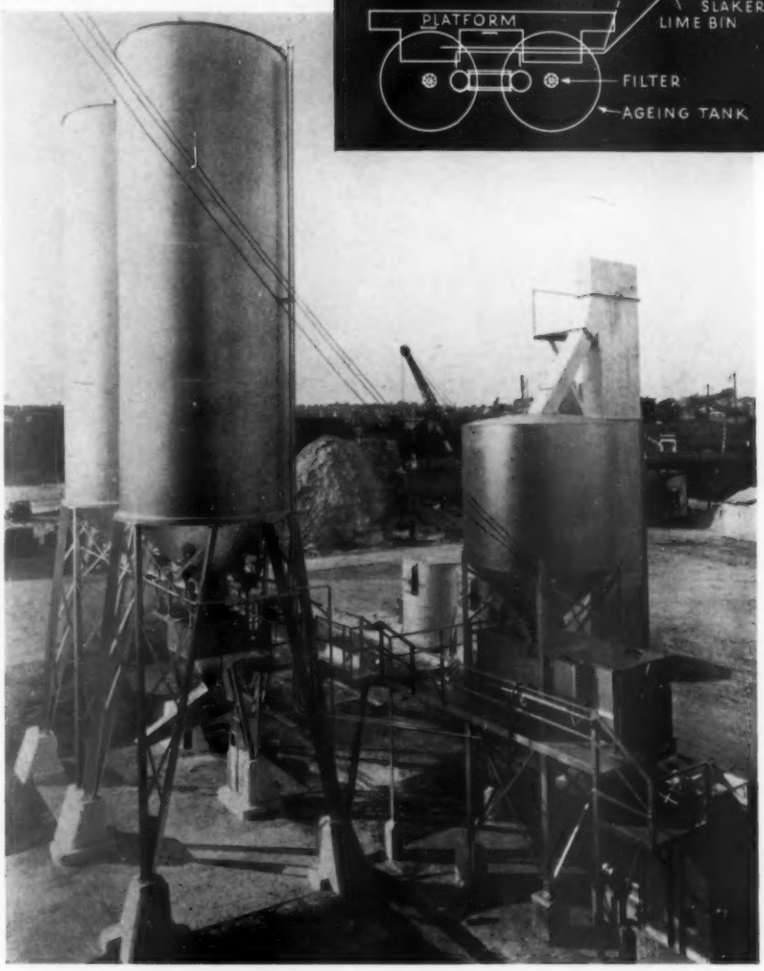
The Brooks-Taylor Lime Putty Plant is a complete unit for preparing and handling *aged* lime putty. It utilizes a patented process, the principal feature of which is the filtering of excess water from the putty during ageing.

STANDARD DESIGN — Brooks-Taylor plants are of standard design. Each installation includes an unloading hopper, lime storage bin, elevator, mechanical slaker, screen and at least two elevated putty storage tanks. A minimum of two tanks are required for continuous operation so that putty can be withdrawn from one while the contents of the other are ageing. Increased capacity is obtained by installing additional tanks.

HOW IT OPERATES — In a Brooks-Taylor plant, quick lime is slaked mechanically, screened and pumped into the elevated storage tanks to age. During the ageing process, the excess water which comes out of the putty is carried off by means of a specially designed filter. When the putty has reached the proper consistency, the filter is closed and the putty is ready for use.

The elevated storage tanks have cone bottoms and the putty is withdrawn from them by gravity into a measuring batcher and dumped directly into mixer trucks for delivery. The desired amount of sand is then added and mixed with the putty enroute.

WHERE IT IS USED—Aged lime putty is used principally in the building field for brick mortar, stucco, plaster and for finish coats.



Standard Brooks-Taylor Lime Putty Plant operated by the Warner Company at Wilmington, Delaware

ADVANTAGES—

Eliminates delay and inconvenience of slaking and ageing quick lime on construction jobs.

Produces a thoroughly slaked and cool lime putty.

Reduces cost due to efficient methods.

Makes highly "workable" mortar plaster and stucco.

Increases covering capacity of plaster and finish coats.

Cuts down waste caused by brick mortar droppings.

Provides builder with a ready-mixed service.

WHO BUILDS IT—The Chicago Bridge & Iron Company has made exclusive arrangements to build BROOKS-TAYLOR lime putty plants. For further information on the Brooks-Taylor method of ageing lime putty or quotations on standard equipment to produce it, communicate with the Brooks-Taylor Company, Inc., at 230 South 31st Street, Birmingham, Ala., or get in touch with us at the nearest office listed below.

CHICAGO BRIDGE & IRON CO.

Chicago .....2451 Old Colony Bldg.	Boston.....1550 Consolidated Gas Bldg.	Dallas.....1486 Dallas Athletic Club Bldg.
New York.....3389—165 Broadway Bldg.	Houston.....2919 Main Street	Detroit.....1552 Lafayette Bldg.
Cleveland.....2264 Rockefeller Bldg.	Tulsa.....1648 Hunt Bldg.	San Francisco.....1092 Rialto Bldg.
Philadelphia.....1645—1700 Walnut St. Bldg.	Birmingham.....1503 North Fiftieth Street	Los Angeles.....1457 Wm. Fox Bldg.

B-486

Plants at BIRMINGHAM, CHICAGO and GREENVILLE, PA.

BUCYRUS-ERIE

THIS 2½-yard shovel is built to meet the requirements of high-speed output in rock and ore. The 85-B carries no excess weight; power is used for digging and not wasted on deadweight. In every part of the cycle, the 85-B has all the speed that the operator can use and, with the new, simple, positive, electrical control that responds instantly and accurately, the operator can use more speed than he has ever been able to use before. Investigate the modern performance and economy of the 85-B!

The massive strength and minimum weight of this 85-B counts for steady output in this New York quarry.

152

BUCYRUS ERIE

EXCAVATING, DRILLING, AND MATERIAL HANDLING EQUIPMENT... SOUTH MILWAUKEE, WISCONSIN, U.S.A.

JAEGERS *Increase Your Business!*

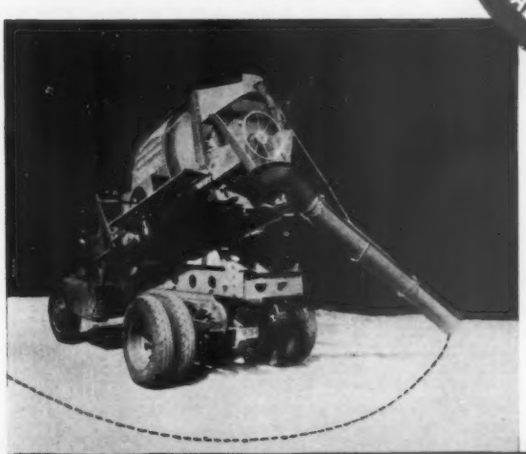
Demand for Jaeger ready-mixed concrete is "on the up" in Knoxville, Tenn. It's increasing in the East, the West, the North— convincing proof that the extra strength and workability of Jaeger concrete make it easier and more profitable to sell.

Many Users Specify Jaeger EXTRA STRENGTH Concrete

Engineers and contractors recognize that Jaeger's Dual Mix Double-End-Cone Drum, with its exclusive method of mixing in mass and its smooth, continuous flow discharge, eliminates segregation and produces a higher strength concrete that is easier to work into forms. Jaeger operators recognize further advantages over their competitors in Jaeger's notably low cost of maintenance and use of lighter, stronger Man-Ten Alloy Steel construction, Two-Range Mixing Speeds and faster One-Man Swiveling Chute and Hopper— which are Jaeger originations. These Jaeger advantages will increase your business too. They mean more customers, more pay loads, lower costs, greater PROFIT for you—a combination which deserves your immediate attention. Write for full information.

THE JAEGER MACHINE COMPANY
602 Dublin Ave., Columbus, Ohio

• *In* KNOXVILLE

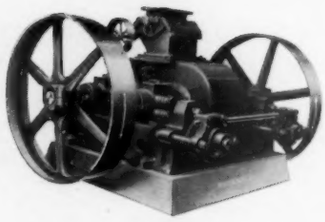


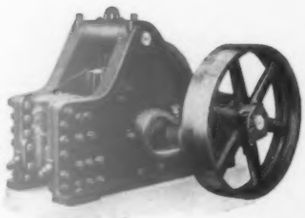
KNOXVILLE SANGRAVEL MATERIAL CO., Knoxville, Tenn., Says: "May, 1935 purchased two 1½ yd. Jaegers. Have since increased our fleet to 8. Well able to produce good quality concrete regardless of the design demanded. Loading can be executed in minimum time and discharge handled by truck driver, a 1½ yd. load being deposited in forms in approximately 3 minutes. During past 12 months have produced over 16,000 cu. yds., and maintenance cost has been almost negligible. Units are on 1½ ton Ford V-8 trucks. Compactness and well balanced load of Jaeger makes handling easy. Demand for our concrete seems to be increasing and we feel our mixers play a very important part." KNOXVILLE SANGRAVEL MATERIAL CO., Knoxville, Tennessee.

JAEGER TRUCK MIXERS

1, 1½, 2, 3, 4, 5 CUBIC YARD SIZES

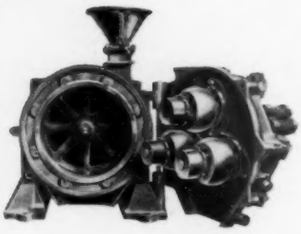
CRUSHERS

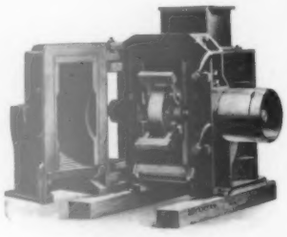




STURTEVANT

SEPARATORS





GRINDERS

EQUIPMENT

FOR THE

PROCESS INDUSTRIES

JAW CRUSHERS

"OPEN-DOOR"

Rotary Crushers
Hammer Mills
Swing Sledge Mills
Ring-Roll Mills
Moto-Vibro and
Broncho Screens
Mixers

ROCK EMERY MILLS
AIR SEPARATORS
AUTOMATIC COAL-
CRUSHER & SAMPLERS
MECHANICAL DEN
and EXCAVATORS
ACIDULATING UNITS

FERTILIZER UNITS

Rock Pulverizing
Mixing
Basing
Shipping
Combination
Tankage
Bone
Scrap
Meat
Shells
Lime, etc.

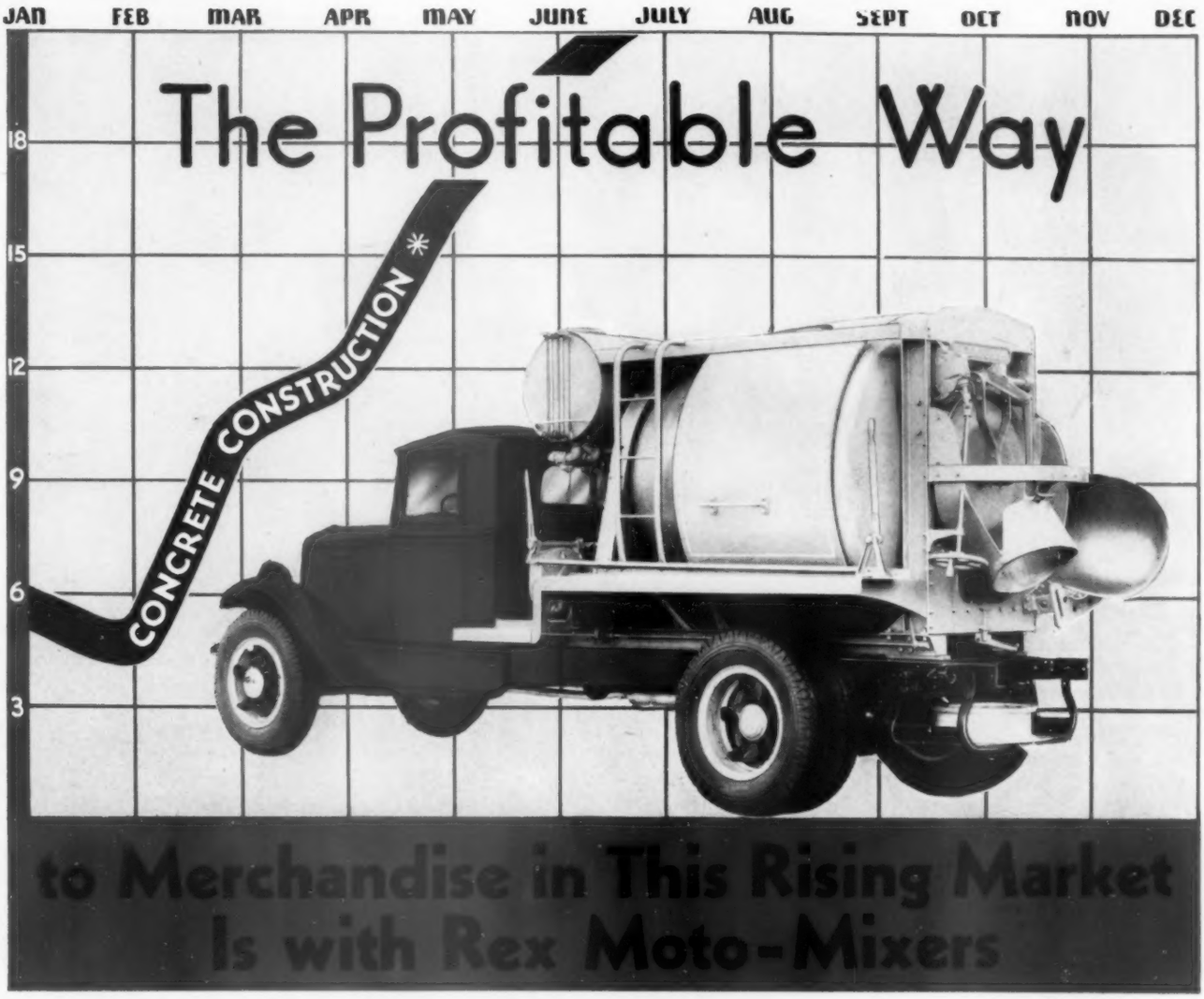
LABORATORY

Crushers
Grinders
Rolls
Screens
Test Sieves
Air Separators

For your ready reference file we will gladly send to you, free of charge, a copy of our "Bulletins in Miniature" covering Crushers, Grinders, Pulverizers, Mixers, Screens, Air Separators, Laboratory Machinery, Etc., Etc.

Just tell us to whom it should be addressed.

STURTEVANT MILL CO. Park and Clayton Sts. DORCHESTER **BOSTON, MASS.**



*** Concrete Construction in Millions of Cubic Yards Based on Cement Shipments**

Cement, sand, gravel and stone are moving faster every month.

The profitable way to get your share of this market, to make your sand, gravel and stone move faster, is to mix and move them in Rex Moto-Mixers and Agitators.

Every month also finds more cement and more aggregate mixed and moved as ready-mixed concrete in Rex Moto-Mixers, *and moved profitably.*

Bigger Pay Loads and Lower Ton-Mile costs spell profit on every yard.

Investigate now this modern, profitable way of increasing tonnage, bettering margins with Rex Moto-Mixers.

Start by sending for the book "Rex Moto-Mixers and Agitators."

CHAIN BELT COMPANY
OF MILWAUKEE

REX *Moto-Mixers*

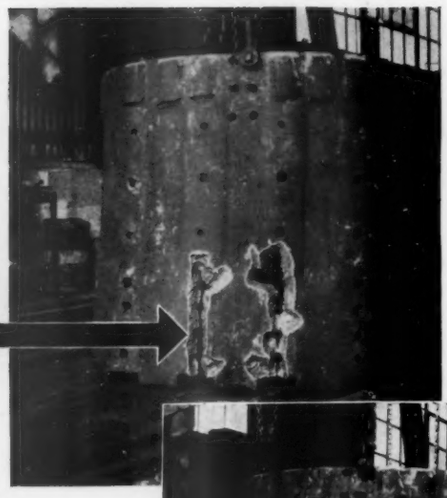
REX

READY-MIXED CONCRETE

Send today for a copy of the book — "Rex Moto-Mixers and Agitators." It describes the 1937 way to secure a better margin on this modern, profitable method of selling cement and aggregates. It illustrates the new 1937 Rex Moto-Mixer features.

CHAIN BELT COMPANY
1646 W. Bruce Street Milwaukee, Wis.

Repaired January 1934
has since handled 243,000 tons
still going strong



welded with
TISCO
TIMANG
THE AIR-TOUGHENING MANGANESE STEEL WELDING ROD

Figure the saving yourself. Instead of relegating this dipper front to the scrap heap two years ago . . . or using repair methods which would be short-lived and of high overall cost . . . it was welded with genuine TIMANG Welding Rod. Today, the front is still in good condition . . . having moved 243,000 tons since the repair was made.

This is typical TIMANG service . . . which explains why TIMANG is so universally used for repairing and building up manganese and carbon steel castings and forgings. The TIMANG weld possesses the same manganese content as the parent metal. The rod flows easily, and the deposited metal does not require water quenching. Thus the finished weld is tough, strong and ductile . . . possessing the same resistance to wear as genuine TISCO Manganese Steel.

TIMANG is sold direct and through sales organizations. Your jobber or distributor handles this rod . . . in some cases under a private trade name. Be sure you insist on the Taylor-Wharton product for all needs. Bulletins on request.

Other TISCO Products:

Manganese steel pump parts, cutter heads, dippers, buckets, dipper teeth, racks and pinions, jaw plates, cheek plates, hammers, liners, mantles, screen cloth, perforated plate, grinding balls, etc.

WRITE FOR BULLETINS

TAYLOR-WHARTON IRON AND STEEL COMPANY

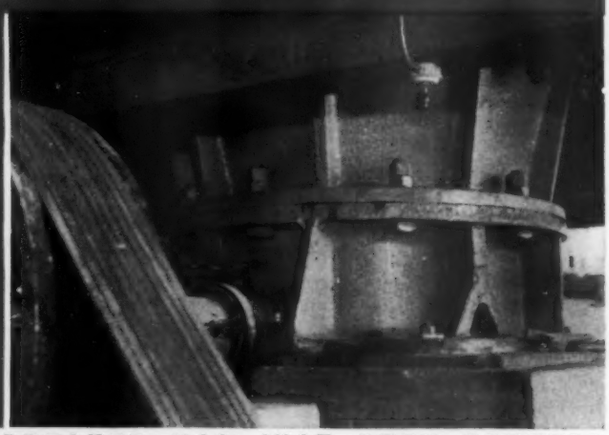
HIGH BRIDGE, NEW JERSEY

PLANTS AT HIGH BRIDGE, N. J.—EASTON, PA.

Offices:

BOSTON • CHICAGO • CLEVELAND • HOUSTON • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • SCRANTON

TELSMITH AT THE GRAND COULEE DAM



A SECOND No. 20 TELSMITH PRIMARY BREAKER HAS JUST BEEN ORDERED

In the million dollar aggregate plant of the M-W-A-K Co. at Grand Coulee Dam, a Telsmith Primary Breaker has been crushing all the oversize from the Brett pit—big, hard, 6 to 20 inch boulders. Operating to capacity for many months, it has set a remarkably successful record for both quantity and quality of output.

Development of the pit has shown the presence of more rock than anticipated. To further increase the production of aggregate, a second No. 20 Telsmith Primary Breaker has now been ordered; and will be installed next to the original crusher.

The short, compact structure, steel frame and steel crown give Telsmith super-stamina. Larger head and concave diameters, with greater receiving and crushing area, allow faster feeding. The unique *parallel pinch* guarantees bigger capacity. That's why Telsmith is the outstanding performer on hard rock—such a satisfactory equipment at Grand Coulee. Bulletin B-15 gives complete details. Write for it today.

BC-1-37

SMITH ENGINEERING WORKS, 504 EAST CAPITOL DRIVE, MILWAUKEE, WIS.

50 Church Street • 201 No. Wells St. • 1013 Commercial Trust Bldg.
New York City • Chicago, Ill. • Philadelphia, Pa.
11 Binney St. • 412 Westinghouse Bldg. • Bruckner M. & S. Co.
Cambridge, Mass. • Pittsburgh, Pa. • Louisville, Ky.
Associates in Canada: Canadian Ingersoll-Rand Co., Ltd.
Montreal, Toronto, Winnipeg, Vancouver

TELSMITH

Jeffrey

OFFERS A BROAD SERVICE

If your costs are loaded by inefficient handling . . Jeffrey is the source from which you can get the right stone products processing and handling equipment to bring those costs down to rock bottom.

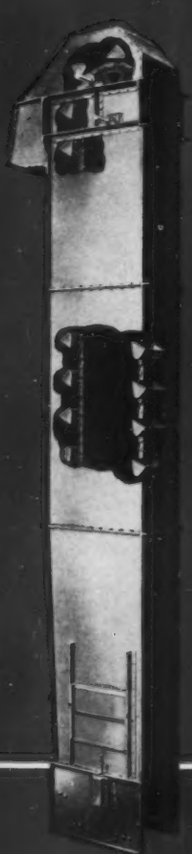
Processing and handling equipment bearing the name "JEFFREY" will enable you to meet strictest specifications and assure you genuine dependability, at a cost that is easy on your pocketbook.

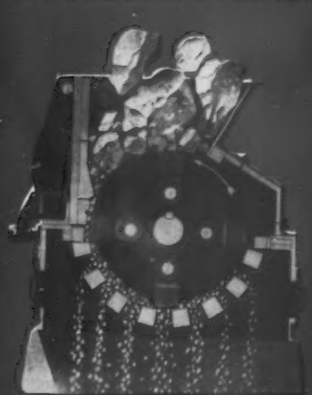
Jeffrey equipment and plant engineering covers the entire stone products industry . . sand and gravel, crushed rock and cement. In this broad line are units and products for standard and special service . . apron, belt and screw conveyors; bucket elevators, feeders and screens; sand dewaterers, portable conveyors and loaders; products, such as chains, sprockets and conveyor idlers for replacement purposes. A unit or a complete plant.

Call on Jeffrey for economical handling and reduction.

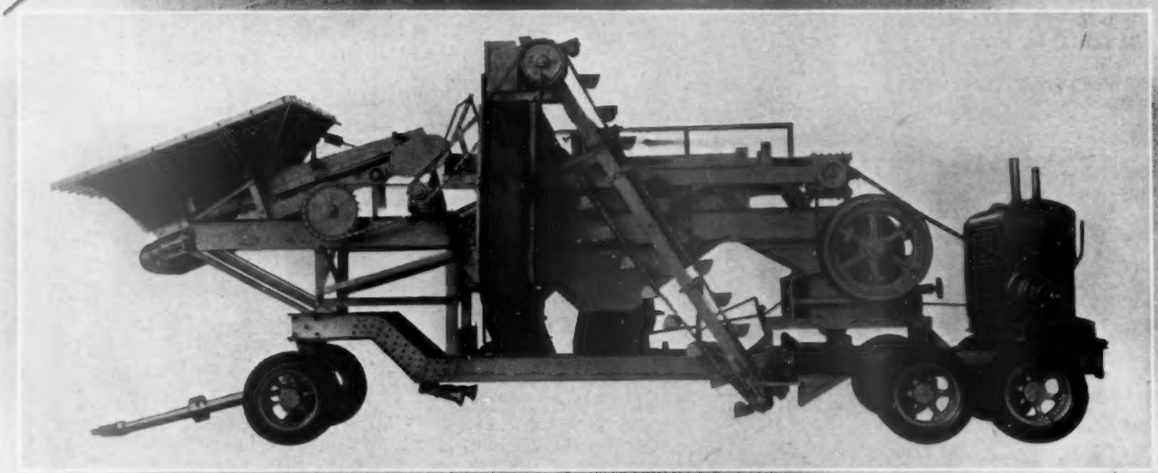
THE JEFFREY MANUFACTURING COMPANY
917-99 North Fourth Street COLUMBUS, OHIO

BELT CONVEYORS
SAND HANDLING AND SCREENING EQUIPMENT
CHAINS
DEWATERERS
SAND SETTLING TANKS
SPIRAL CONVEYORS
BUCKET ELEVATORS
ELECTRIC VIBRATING SCREENS AND FEEDERS
CRUSHERS, PULVERIZERS AND GRINDERS
PORTABLE LOADERS AND CONVEYORS
APRON FEEDERS
TRANSMISSION MACHINERY

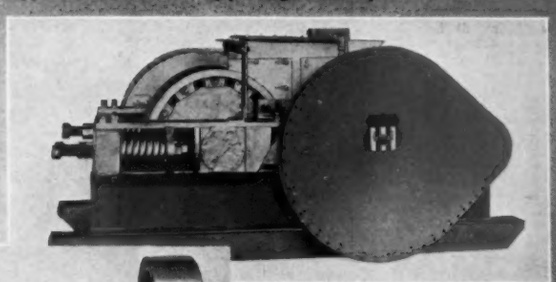




THE 1937 CEDAR RAPIDS PROFIT MAKERS



Heading the list of Cedar Rapids Profitmakers for 1937 are the Straight Line Portable Rock and Gravel Plants. The Super Tandem Type is shown in the upper right handpicture. The Junior Tandem Type is shown immediately above.



Above: Cedar Rapids Roll Crusher. Four sizes.
Left: S.K.F. Roller Bearing Jaw Crusher. Many sizes.
Below: Cedar Rapids-Symons Horizontal Vibrator Screen. All standard sizes.

Other Iowa Profitmakers

Asphalt Mixing Plants (Hot or Cold Mix)

Traveling Road Mix and Rapidmix Plants

Portable Quarry Plants

Washing Plants

Tractor-Crusher Roadside Plants

Belt Conveyors — Screens — Bins — Bucket Elevators

Portable Placer Machines

Gravel Stabilizer Plants

A Complete Line of Portable and Stationary Material Handling Equipment

These are the Profitmakers for 1937

Cedar Rapids Portable Rock and Gravel Plants lead the field because they make greater profits for their operators. They are Profitmakers because they give greater capacity at lower operating costs. Change to Iowa for Profits. Write for bulletins.

IOWA MANUFACTURING COMPANY

CEDAR RAPIDS, IOWA, U. S. A.

THEY'RE ON THE PAYROLL

at 18¢ an hour each

EACH of these "Caterpillar" Diesel Engines "packs a punch" that rates 125 horsepower. They divide the work of operating a Stephens-Adamson crusher for the Utah Sand & Gravel Products Corp. in supplying track ballast for the Western Pacific Railroad. Crushing and screening machinery, circuit conveyors, vibrating screen, finished-material and waste conveyors—all perform their jobs efficiently with "Caterpillar" Diesel power.

The plant has been in operation since the spring of 1936—attended by two men—turning out 150 cubic yards per hour—running 22½ hours a day, six days a week. . . . *And each of these two engines has cost for fuel and lubrication only 18c an hour!*

Similar applications prove the economy of Diesel power —and the profitable performance and low operating cost of power produced by "Caterpillar" Diesels. Find out about them—there's a dealer near you.

CATERPILLAR DIESEL ENGINES

REG. U. S. PAT. OFF.

CATERPILLAR TRACTOR CO.
PEORIA, ILLINOIS

WORLD'S LARGEST MANUFACTURER OF DIESEL ENGINES

Order This Book...and Discard Your Old "Prospect List"

The 1937 Directory section of Pit and Quarry HANDBOOK is the most complete ever published. It is up to the minute—as modern as skill and money can make it. It's checked and double checked.

It gives you the names of the companies, their officers, the number and locations of plants, their capacities and equipment, and the names of the men who buy.

The technical section gives the latest production methods and practices. And there are consolidated catalogs of equipment.

It's Alphabetical

By Company Names →

National Portland Cement Co. PC
420 Bourse Bldg., Philadel[illegible]a, Pa.
W. M. Richards[illegible] B. Franks (Bethlehem[illegible] gen. mgr.; Geor[illegible], John Shibe, tr[illegible]ethlehem, Pa.), gen. su[illegible]ntmann (Bethlehem, Pa.), ch.
Plant: Brodhead, Pa.

ALPHABETICAL

It's Geographical

By Plant Locations →

BRODHEAD Northampton
(P. O. Bethlehem.)
National Portland Cement Co. PC
Branch of Philadelphia, Pa.
Plant Executives: H. [illegible]endel, supt.; A. P. Hachtmann[illegible]. Franks, v.-pres., gen [illegible]ipment.
Pro[illegible] Capacity: Portland ce[illegible]
Na[illegible] Deposit: Limestone. Stripping: Shovel. Drilling and Blasting: Blast hole drills. Digging and Loading: 2 P. & H. 2-cu. yd. electric shovels. Delivery to [illegible]

GEOGRAPHICAL

A 10% Discount for Cash with Order Before February 20

You'll order the **HANDBOOK** sometime soon—and you can save 10 per cent by ordering now—with cash. The edition will be ready March 1st—and you'll get one of the first copies received from the binders.

So send in your order **NOW**—this discount applies only before publication, and is good on either the complete **HANDBOOK** and **DIRECTORY**, or on the separately reprinted **DIRECTORY**.

Order This Key to More Sales . . . . Today

Pit and Quarry,
538 S. Clark St., Chicago, Ill. Date.....

Please send.....copies of the 1937 HANDBOOK ($10.00 per copy) ☐ Check enclosed .....
Please send.....copies of the 1937 DIRECTORY ($10.00 per copy) ☐ Send Invoice with book

Name ..... Title .....

Company .....

Town ..... State .....

Your Book

More than 100 large illustrations are contained in this **new** Koehring Pictorial presentation. This book was prepared for you — for your reference file. It presents the application of equipment to all types of construction activity. Write for your copy today. Use the coupon—no obligation.

KOEHRING COMPANY
3026 W. CONCORDIA AVENUE
MILWAUKEE, WISCONSIN

Mail *my* copy of the Koehring Pictorial to:

Name.....

Occupation.....

Company.....

Street Address.....

City..... State.....

Investigate Blaw-Knox TRUKMIXERS

We would like to tell you why Blaw-Knox TRUKMIXERS and Agitators not only produce *better concrete*—but save you money in low depreciation and maintenance costs.

You should know about the mixing blade arrangement and the faster, superior mixing action; the accurate water control, and the fine points of engineering and construction which make the Blaw-Knox Trukmixer a dependable unit for uninterrupted service.

Investigate Blaw-Knox Trukmixers.

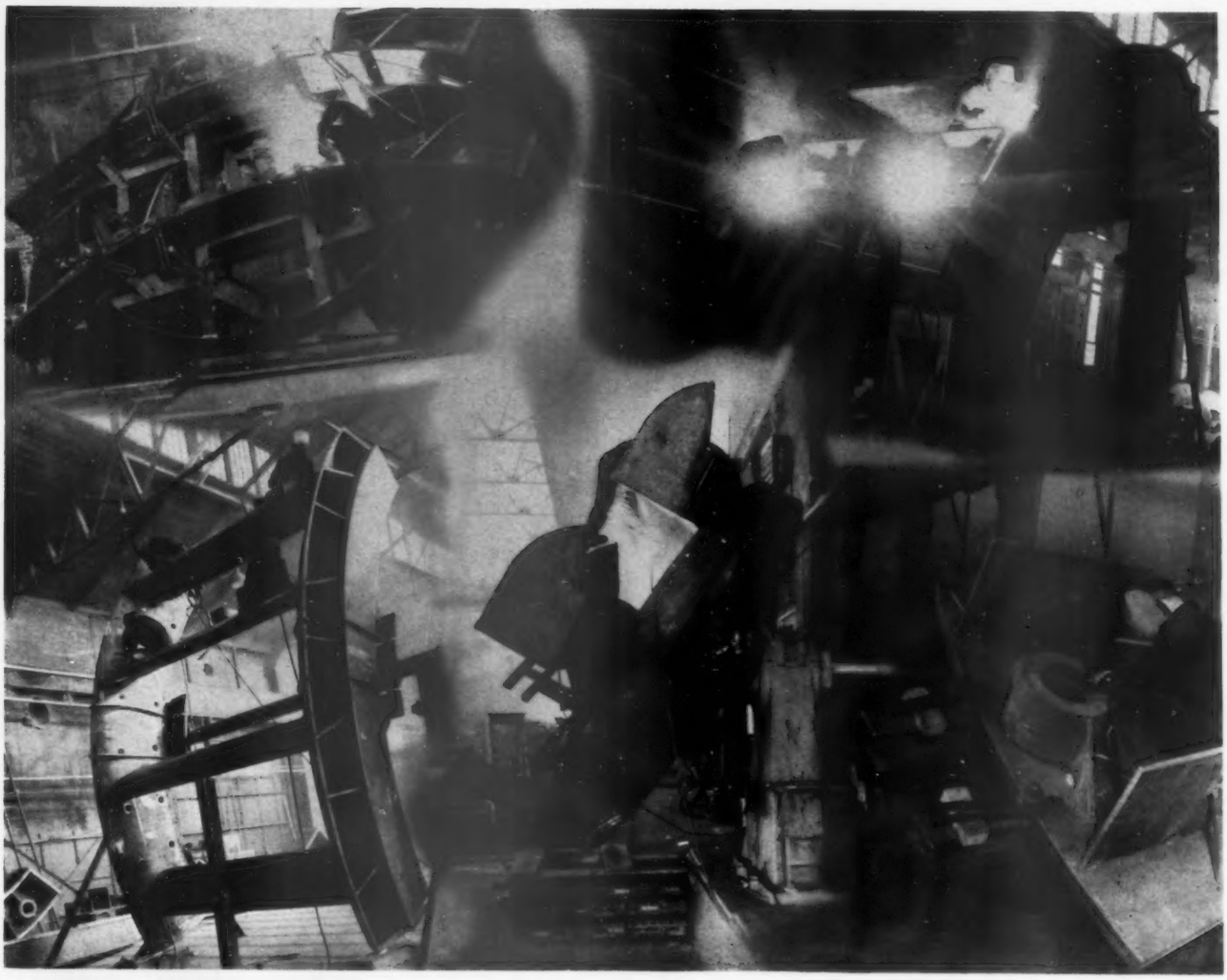
BLAW-KNOX COMPANY

NEW YORK • CHICAGO • PHILADELPHIA • BIRMINGHAM

Representatives in Principal Cities

2080 Farmers Bank Building

Pittsburgh, Pa.



WELDING by SMITH

FOR solving a major equipment problem—"Welding by Smith!" . . . to your specifications and design, or to ours . . . a practical, workable method yielding real savings in costs to you, with reduced weight, greater strength, improved quality and quicker delivery . . . results which are only possible because of our complete welding and machine tool equipment, backed by our long experience and high standards of workmanship . . . ***facilities now available to you for the first time!***

Investigate this Service. Discover how economically Smith can solve your heavy welding problems! Write today!

S. MORGAN SMITH COMPANY, YORK, PA.

now...

Glass *won't shatter!*

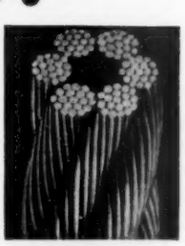
now...

Wire rope *won't fly apart!*

● You can hit safety glass with a baseball, but it won't shatter—because it is safety glass. You can remove the seizing from preformed wire rope, but it won't fly apart, "explode" or "broom" —because it has been preformed.

Preforming makes every wire and strand lie in its appointed place, naturally, comfortably, relaxed. Preforming tends to eliminate all internal torsional stress. It resists crankiness and tendency to kink.

Ask us to send you a sample of preformed wire rope. Learn all the facts about the true superiority of preformed rope. For many wire rope applications, preformed rope will give you much greater dollar value.



PREFORMED

NON-PREFORMED

LICENSEES UNDER PREFORMED WIRE ROPE PATENTS
520 North Michigan Avenue • Chicago, Illinois

Preformed WIRE ROPE

for SAFETY · ECONOMY · EFFICIENCY

Expand Your Market

WITH A-W PORTABLE CRUSHING PLANTS

. . . IT'S *Sound Profit* INSURANCE

Put yourself in line for the desirable business that's beyond the distance range of stationary plants. You can do it economically with A-W Portable Crushing Equipment . . . assuring yourself the extra volume of business to be obtained through contracts now out of reach.

Easily and inexpensively set up near the job, an A-W Portable Plant saves haulage costs . . . Protects present markets . . . Lets you expand . . . Enlarges your sales possibilities. Provides practical mobility in equipment that has the capacity and endurance of equivalent fixed plant crushing machinery.

Each unit is self-contained. Oversize S.K.F. roller bearings and shafts permit the use of larger jaws operating at higher speeds . . . assuring the highest possible output. Compact for easy transportation, A-W Portable Crushers can be set up for operation in a few hours. No elevators to be folded and unfolded . . . no pits to be dug for delivery conveyors or elevators. Mail coupon for full details.

THE AUSTIN-WESTERN ROAD MACHINERY CO
AURORA, ILLINOIS

Built TO OUTPERFORM!

Austin-Western

The Austin-Western Road Machinery Co., A-7, Aurora, Ill.

☐ Send a salesman
Tell me more about the

☐ Crushing & Washing Plants
☐ Motor Grader
☐ Roll-A-Plane
☐ Blade Grader
☐ Motor Sweeper
☐ Elevating Graders
☐ 5-Yd. Scraper
☐ 12-Yd. Scraper
☐ Trail Cars
☐ Shovels and Cranes
☐ Bituminous Distributors
☐ Snow Plows

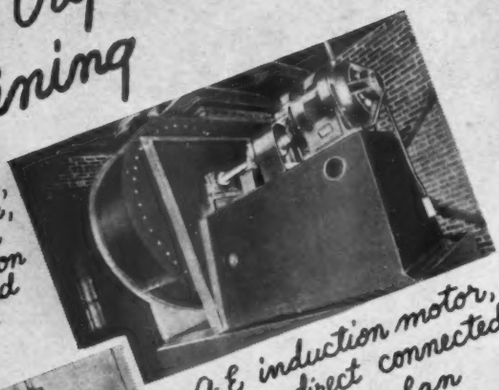
C-704

Name .....

Address .....

City ..... State .....

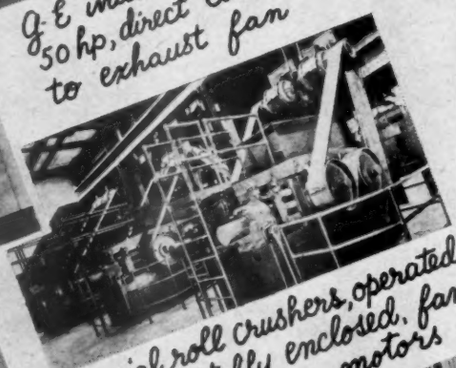
Notes Made on factory trip to Minnesota Mining



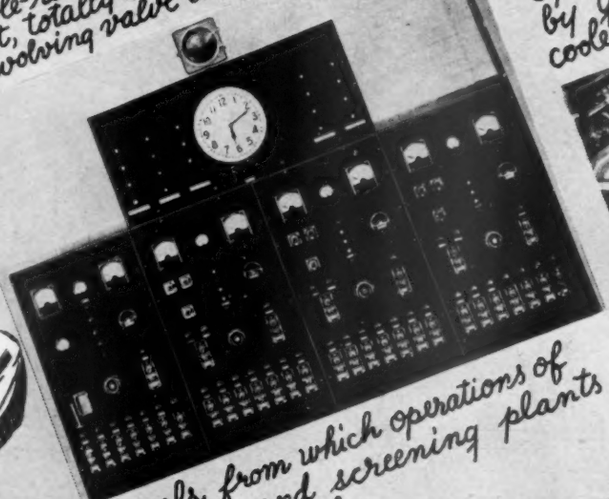
G-E totally enclosed, fan-cooled d-c motor, 20 hp, connected through reduction gear to oil-fired rotary kiln

G-E induction motor, 50 hp, direct connected to exhaust fan

G-E gear-motor, double-reduction unit, totally enclosed, flange-mounted, on revolving valve above belt conveyor



Special roll crushers, operated by G-E totally enclosed, fan-cooled induction motors



Panels from which operations of crushing and screening plants are controlled

G-E totally enclosed, fan-cooled, wound-rotor induction motor, 100 hp, operating crusher

G E N E R A L

ANOTHER TRIP SHOWS HOW

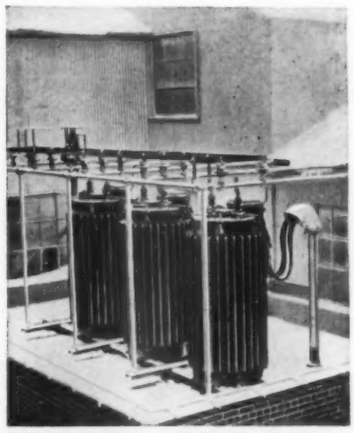
Minnesota Mining and Manufacturing Co.

Gets Lower Costs with G-E Equipment

THAT'S what the engineers at this rock-products plant at Wausau, Wisconsin, told us—that they were getting lower costs through the efficient performance of their electric equipment, which is G-E throughout.

Quarry-sized quartzite rock is reduced and processed to provide colored granules for use in the roofing industry. Forty G-E motors, ranging from 1½ to 100 hp, drive the machinery. Provided with matched control and exactly suited to the job, these motors use the minimum amount of power.

The new transformers, too, have helped effect savings by their high efficiency in reducing transmission voltages to the required values. The simplicity and tested construction of all the equipment result in low maintenance costs and low operating expense.

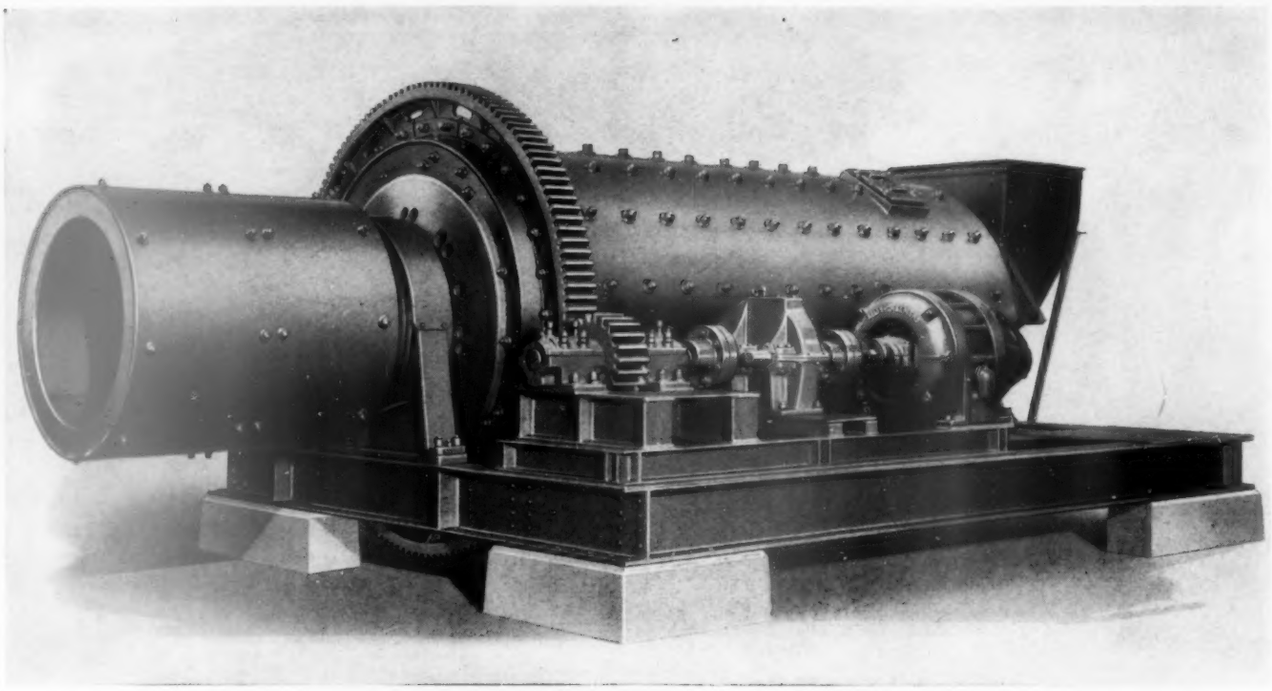


G-E oil-immersed transformers, 333 kva, give high efficiency in transformation of voltage

Unless your plant is exceptional, *your* operating expense could be reduced by the use of new G-E equipment. For information on electric equipment for shovels, quarry hoists, rock crushers, material conveyors, and automatic kiln-temperature control, call the nearest G-E office. We shall be glad to help you plan a co-ordinated electric power installation. General Electric, Schenectady, New York.

011-152

GENERAL ELECTRIC



A New and Better Machine for Washing and Scrubbing —

After months of experimentation and research in their own laboratories and in the field Allis-Chalmers engineers have developed a new type of machine, the BLADE MILL, for washing, disintegrating, and cleaning ores, stone and other products containing a large amount of clay, slime, or other materials that are detrimental to subsequent processes of treatment. The inner periphery of this new mill is provided with a series of quick-removable, log washer type teeth arranged for angular adjustment on special bases to which the teeth are attached. The disintegration is effected by combined cutting and rolling action in water within the mill, using a relatively deep bed.

It has a much wider application than the conventional log washer, as it can handle material up to 12 inches or larger in size. The mill is arranged for variable speed and variable pulp level. The combination of angular adjustment of blades, with variable depth of bed and speed, provides unusual flexibility. It has a wide range of adaptability both for the treatment of ores and in the aggregates industry.

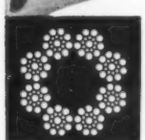
Inside of Blade Mill showing Adjustable Log Washer Teeth, and tangential variable depth discharge lifters.

EQUIPMENT ENGINEERS TO INDUSTRY

ALLIS-CHALMERS

MILWAUKEE WISCONSIN

THIS WIRE ROPE IS BUILT FOR SPEED



Select the Rope that Fits Your Job

An eight strand wire rope has a larger hempen core, lighter wires and less metallic cross sectional area than a six strand rope of the same size. The cushioning effect of the larger core gives the rope extreme flexibility and elasticity. This construction is especially recommended when, with light loads, rapid acceleration is required. The large hempen core cushions and dampens the shock due to rapid acceleration. If loads are heavy and abrasion is a factor of destruction, eight strand rope will not give as long service as six strand rope. Economy dictates that you select the rope for the work. Tell us about your wire rope installation and we will tell you the most economical rope construction for your purpose.

•

WICKWIRE SPENCER STEEL COMPANY, *General Offices:* 41 East 42nd Street, New York. *Sales Offices and Warehouses:* Worcester, New York, Chicago, Buffalo, San Francisco, Los Angeles; *Export Sales Dept.:* New York.

WICKWIRE SPENCER SALES CORPORATION, New York, Chattanooga, Tulsa, Portland, Seattle.

WIRE ROPE by Wickwire Spencer

Wickwire Spencer also manufactures all sizes and types of Wire Rope in Wisscolay.

WICKWIRE SPENCER STEEL CO.
41 East 42nd St., New York City

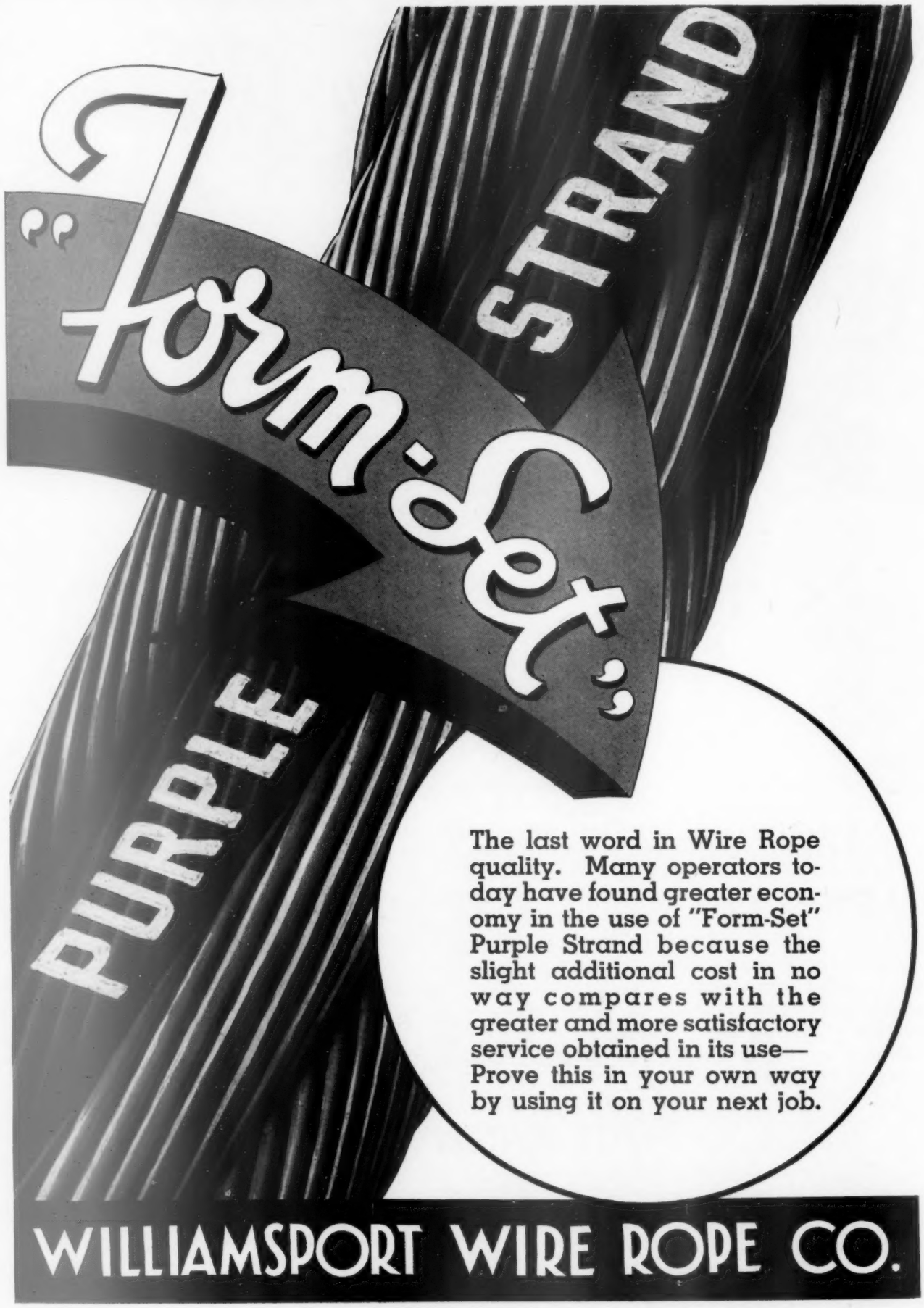
Please send me your new Rope Manual that tells how to make wire rope last longer.

Name_____

Firm_____

Address_____

City_____ State_____


"Form-Set"
PURPLE STRAND
The last word in Wire Rope quality. Many operators today have found greater economy in the use of "Form-Set" Purple Strand because the slight additional cost in no way compares with the greater and more satisfactory service obtained in its use— Prove this in your own way by using it on your next job.
WILLIAMSPORT WIRE ROPE CO.

Williamsport, Pa. 122 So. Michigan Ave., Chicago, Ill.

Other Offices in All Principal Cities

GMC

THE TRUCK OF VALUE

INTRODUCING

A LOW-PRICED GMC "CAB-OVER-ENGINE" TRUCK

. . . of a complete line of *truck-built* GMC cab-over-engine models ranging in capacity from 1½ to twelve tons . . . with distinctive streamstyling and exclusive "dual-tone" color design that sets a new standard . . . with rear-opening doors, utmost accessibility for servicing, exceptional comfort for driver, maximum visibility, all-steel "helmet-top" cab, correct wheelbases, forward location of front wheels and many other desirable features.

1½-ton chassis, $635 f.o.b. Pontiac, Michigan. Complete with cab only **$830**

See these COE values as well as the complete GMC line! . . . All prices f.o.b. Pontiac—Time payments through our own Y.M.A.C. Plan at lowest available rates

GENERAL MOTORS TRUCKS & TRAILERS

GENERAL MOTORS TRUCK & COACH
DIVISION OF
YELLOW TRUCK & COACH MANUFACTURING COMPANY, PONTIAC, MICHIGAN

For Uniform Grinding...

USE THESE *Uniform* GRINDING BALLS

EVERY ball exactly like its "brother" — that's what you want in grinding balls. And that's what you get in forged balls made by the Lorain Division.

Uniformity starts with the ore and follows through every step of the steel-making, right up to where the bars are heated and forged into solid spheres of homogeneous steel. Heat treatment and finishing carry this improvement forward to give you the toughest grinding balls available.

For cement and other grinding you can get Lorain Grinding Balls in these diameters — ½", ⅝", ¾", ⅞", 1", 1¼", 1½", 2", 2½", 3", 3½", 4", 4½" and 5".

OTHER LORAIN PRODUCTS

Mill Liners and Screens of Manganese, Chrome Nickel and plain Carbon Steel or Hard Iron; Hammers for Swing Hammer Mills; Industrial Cars and Trackwork.

CARNEGIE-ILLINOIS STEEL CORPORATION

Lorain Division — *Johnstown, Pa.*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

BUILT FOR THE PIT!

★ ★

Fully enclosed cab that can be locked up.

★ ★

Cast steel bases far superior to welded structural design —long life!

★ ★

Side frames for operating machinery cast integrally with rotating base—no possible chance of misalignment of shafts in years of service.

★ ★

Cool running smooth acting cone clutches.

★ ★

Northwest Independent crowd that utilizes force that other shovels waste.

★ ★

Welded boom and dipper sticks. No Northwest welded boom has ever failed.

★ ★

Manganese front dipper.

★ ★

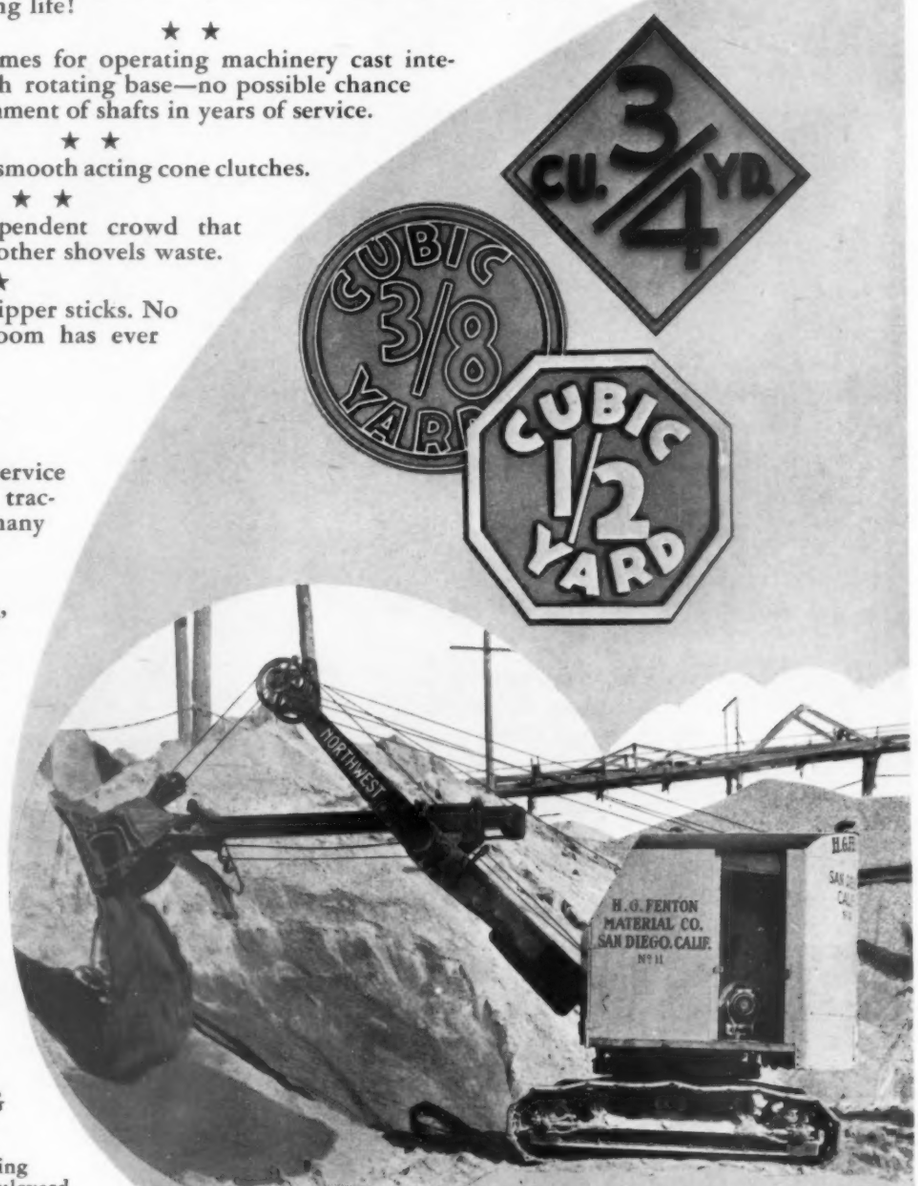
Crawlers built for shovel service —beyond comparison with tractor crawlers furnished on many small machines.

★ ★

Built in four capacities, 3/8, 1/2, 5/8 and 3/4 cu. yds.

Other machines 1 cu. yd. capacity and larger.

Gasoline, Oil, Diesel or Electric.



Model 18, 1/2 yd. Northwest Shovel working in the yards of the Fenton Material Co. at San Diego, California. This is the tenth Northwest purchased by this concern over a period of thirteen years. Repeat orders tell the story of satisfactory service.

NORTHWEST ENGINEERING COMPANY

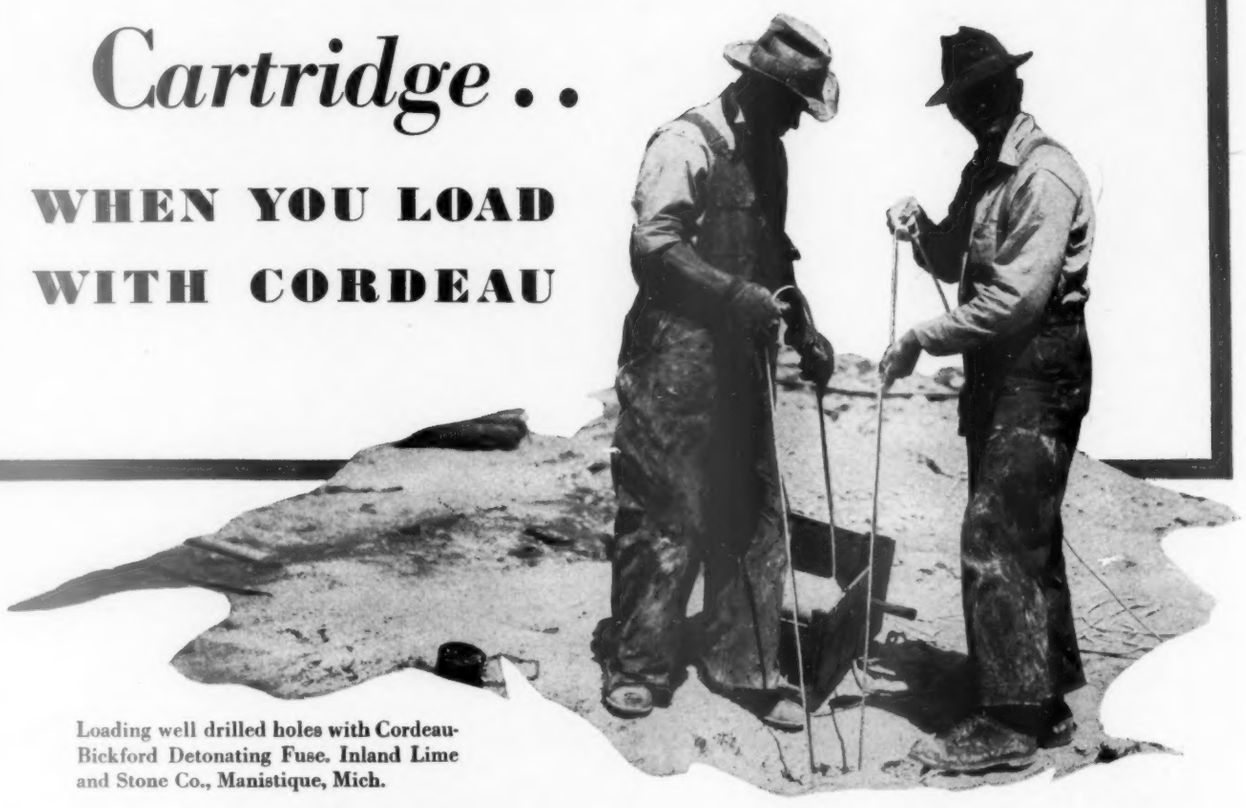
1703 Steger Building
28 East Jackson Boulevard
Chicago, Illinois

SHOVEL . . . . .
CRANE . . . . . **NORTHWEST**
DRAGLINE . . . .
TRUCK SHOVEL
TRUCK CRANE

BUILT IN A RANGE OF 17 SIZES—3/8 YD. CAPACITY AND LARGER

Every Cartridge a Primer Cartridge . .

WHEN YOU LOAD WITH CORDEAU



Loading well drilled holes with Cordeau-Bickford Detonating Fuse. Inland Lime and Stone Co., Manistique, Mich.

THIS is one of the Cordeau features that have made the giant blast not only possible but highly profitable. The Inland Lime and Stone Company has found this to be the case—in fact they are credited with some of the largest blasts on record.

Cordeau-Bickford is an insensitive detonating fuse. Since each cartridge goes with the force of a primer cartridge, greater tonnage and easier mucking result. Split second rotation in a planned Cordeau hook-up allows relief of burden. Loading is accomplished with less danger to the men. These advantages all result in lower operating costs—greater efficiency.

Remember, Cordeau-Bickford Detonating Fuse is manufactured with the same precision that has made Ensign-Bickford Safety Fuse famous for its dependability since 1836. Write for the Cordeau book—it's free.

CORDEAU-BICKFORD DETONATING FUSE

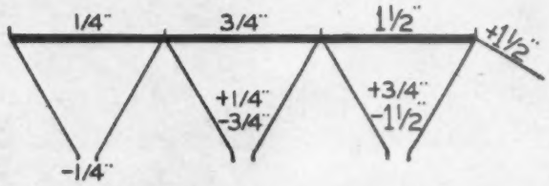
THE ENSIGN-BICKFORD CO.
MAKERS OF ENSIGN-BICKFORD

SIMSBURY, CONNECTICUT
SAFETY FUSE SINCE 1836

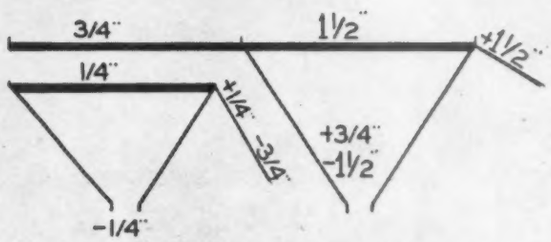
CB61

Only a Flat SYMONS SCREEN
offers so many screening combinations

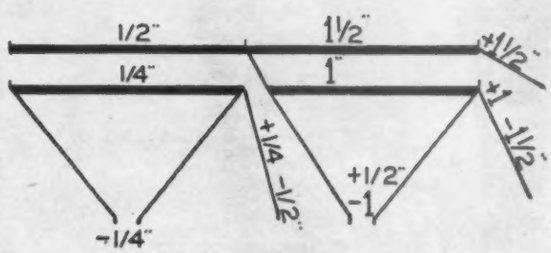
Three of the many unusual Symons Screen arrangements



Long single deck screen giving three screened sizes and an oversize where this type of screen is preferred.



Single deck screen with drop deck for removing a small amount of fines and producing two screened sizes.



With a gap in the lower deck of a double deck screen, four screened sizes and an oversize can be secured.

With the growing demand for better screened materials, the advantages of flat screening is being more and more recognized. It is generally agreed that a level screen sizes closer. It is also adaptable to a wide variety of combinations that meet the requirements where unusual conditions may prevail.

Since the headroom required for Symons Screens does not increase with greater screen length, it is possible to build screens longer and in a variety of combinations. Drop decks can be added to single and double deck screens if such an arrangement is best suited to the material and sizings desired. With a flat screen it is possible to place a gap in the lower deck and produce four sizes from one double deck screen.

These and other combinations show the flexibility of Symons Screens and their adaptability in the solution of unusual screening problems.

If you are interested in better screening and are considering changes in your screening equipment, see what Nordberg has to offer in the Symons Screen.

NORDBERG MFG. CO.

MILWAUKEE, WIS.

New York City	London	Los Angeles
60 E. 42nd St.	Bush House	Subway Term. Bldg.

A GREAT NEW BUSINESS FOR AGGREGATE PRODUCERS

Called "the greatest discovery in road construction in years" by the U. S. Bureau of Public Roads, stabilized soil roads to be built in the immediate future call for enormous quantities of material. This demand opens wide the door to an immediate, continuous and profitable market. The soil combinations used include not only ordinary aggregates but also portions of sand, silt and clay. Much of this material is available at hand, from pit overburden or waste piles from washing. Aggregates producers generally have most of the equipment necessary for mixing and loading also, so it costs them very little to get into a very big business — a business which will be taken care of by state and county owned pits and plants unless aggregates producers are on their toes.

A typical stabilization plant set-up. Aggregates, binder soil and calcium chloride are fed into a pug-mill, thoroughly mixed, and conveyed to a loading bin for delivery to trucks.

Binder Soils and Calcium Chloride the Secret of Success

The binder soil, generally clay or clay loam, exerts tremendous bonding force when in a damp or plastic state. Calcium Chloride attracts, holds and regulates the moisture, to keep clay damp and dustless and to prevent crumbling or separating of aggregates and binder soils. These effective binder soils are generally waste to pit owners, yet absolutely necessary in stabilized soil mixtures. Thus is waste turned to profit.

Free Information on How to Build

The Calcium Chloride Association has data and drawings showing details of plant construction. Write for them now. Get your share of the business this year.

MANY MARKETS

- Rural Roads
- City Streets
- Park, Cemetery and Private Drives
- Factory and Public Parking Areas
- Tennis Courts, Playgrounds, etc.

Plant-mixed stabilized material on road, ready for spreading and shaping.

A smooth, dustless, all-weather road produced with plant-mixed stabilized material.

CALCIUM CHLORIDE ASSOCIATION

Solvay Sales Corporation . . . . . 40 Rector Street, New York City
Michigan Alkali Company . . . . 60 E. 42nd Street, New York City
The Dow Chemical Company . . . . . Midland, Michigan
The Columbia Alkali Corporation . . . . . Barberton, Ohio

CALCIUM CHLORIDE

FOR STABILIZING ROAD SURFACES

ECONOMIZE

BY INSTALLING *Republic* CONVEYOR BELTING

DESIGNED FOR YOUR SPECIAL NEEDS

The many grades of Republic Conveyor and Elevator Belting have been designed with a thorough understanding of mining and quarry operations and of all conditions that must be met. Lengths and elevations of conveyors, tonnage and classes of materials, power requirements, types of drives, methods of loading and discharge, exposure to deteriorating influences and all other factors have been analyzed with an eye toward developing the highest belt efficiency and longest belt life. Republic has for many years enjoyed a nation-wide reputation for having achieved these results.

Let us help you to make more money through safer and more efficient operations—less repairs and replacements—smoother and more lasting conveyor belt performance. Republic offers you a technical service with a trained man right on the job—supporting your efforts with the experience acquired by scores of improvements that Republic Conveyor Belting has accomplished in other units of your industry.

The **REPUBLIC RUBBER** *Company*

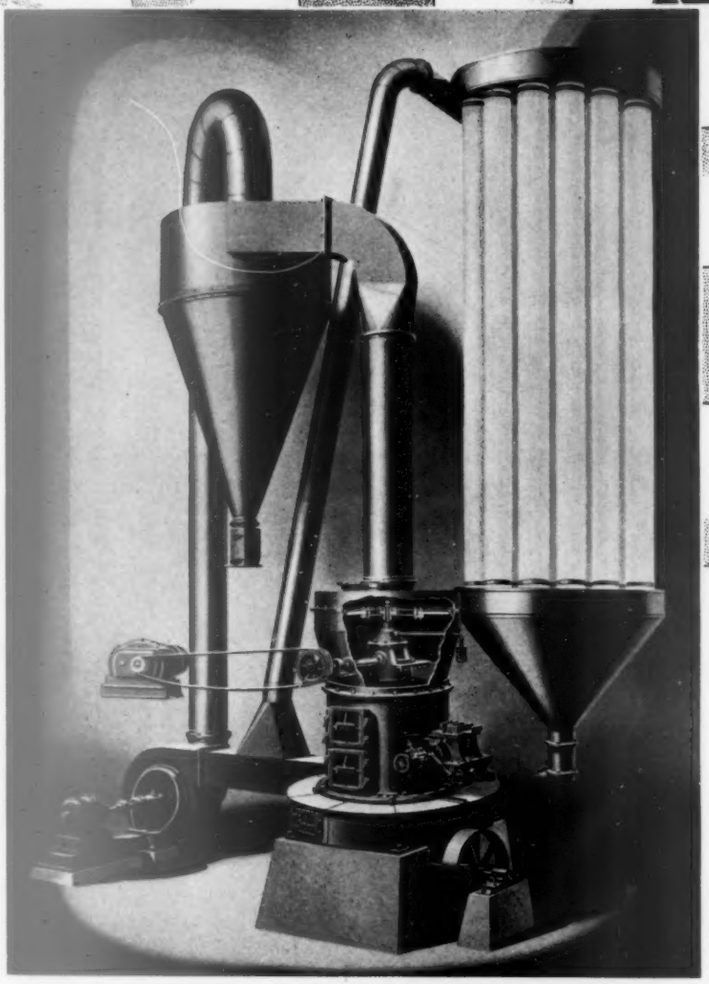
YOUNGSTOWN • OHIO

Manufacturers of HOSE BELTING • PACKING MOLDED PRODUCTS.

ORDER REPUBLIC RUBBER PRODUCTS FROM YOUR DISTRIBUTOR

RAYMOND WHIZZER - EQUIPPED MILLS

Over 100 Sold in Two Years



Raymond Whizzer Type Roller Mill
Write for Bulletin No. 28

Seldom has a machine met such quick and wide acceptance. The reason is performance—in terms of capacity increase and cost reduction that challenge the record of any similar mill. One installation sells another, because the Whizzer Type Roller Mill actually shows production economies sufficient to liquidate the investment in a few months' operation.

•

High Capacity—In fine grinding operations, the Roller Mill with Whizzer Separator shows an increased capacity of 25% to 50% in pulverizing the harder materials, and up to 100% on softer materials.

•

Low Costs—In a typical installation for grinding limestone, the power costs figured on a 24-hour basis for a monthly period were reduced 50% by using a Whizzer Separator on the Mill instead of an ordinary separator.

•

Flexible Control—A variable speed control on the Whizzer drive provides for an infinite range of fineness from 80% minus 100-mesh to 99.75% minus 325-mesh simply by shifting a lever while the mill is running.

RAYMOND PULVERIZER DIVISION

COMBUSTION ENGINEERING COMPANY, Inc.

1321 North Branch Street • CHICAGO

Sales Offices in Principal Cities

Canadian Repr.: Combustion Engineering Corp., Ltd., Montreal

"You don't get any of that jerky action with these tractor-type crawlers. You start smoothly—move smoothly because there's true rolling action throughout the whole assembly."—Jack Lumree—Shovel Operator.

Look at these Tractor-type shoes

—— GET THE STORY OF TROUBLE-FREE TRAVEL

● The shoes used on these tractor-type crawlers are made of tough alloy rolled steel, heat-treated for extra strength. They're uniformly strong throughout—no hidden flaws—no weak spots. Designed with hinge action, they overlap each other. Stones can't get between. There's no clogging . . . no breakage . . . no loss of tractive power. They're renewable—interchangeable. You simply remove four bolts to lift out any shoe without disturbing the crawler track. It's no exaggeration to say that these P&H excavators with tractor-type crawlers will travel faster and farther with less trouble than any other machines. It's another feature that makes P&H Pacemakers faster on the job.

HARNISCHFEGER CORPORATION
4451 W. National Avenue *Established 1884* Milwaukee, Wisconsin
Warehouses and Service Stations:
Hoboken — Memphis — Jacksonville — Dallas — Seattle — Los Angeles — San Francisco

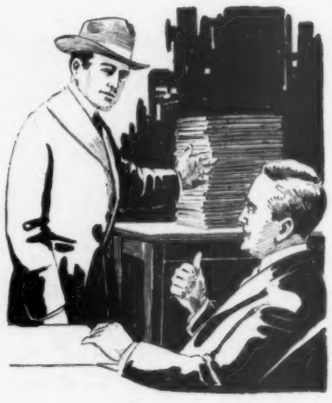
HARNISCHFEGER CORPORATION
EXCAVATORS • ELECTRIC CRANES P&H SERVICE HOISTS • MOTORS • ARC WELDERS

The Producer's Guide to Buying

By Ernest V. Madison

In a producer's private office, on a table near his desk, was a neatly arranged pile of back numbers of a business paper.

A caller's curiosity was aroused. "Why do you keep those old magazines?" he asked. "You do not read them more than once, do you?"



"That pile of magazines is my buying guide," the producer replied. "I am, as you know, a very busy man, kept on the job most of my time, but the advertising pages of this magazine keep me in touch with the outside activities of my business field—with the progress in design and manufacturing of equipment, materials and supplies suitable for my plant."

"But doesn't the reading of these advertisements take a lot of your time?" the caller asked.

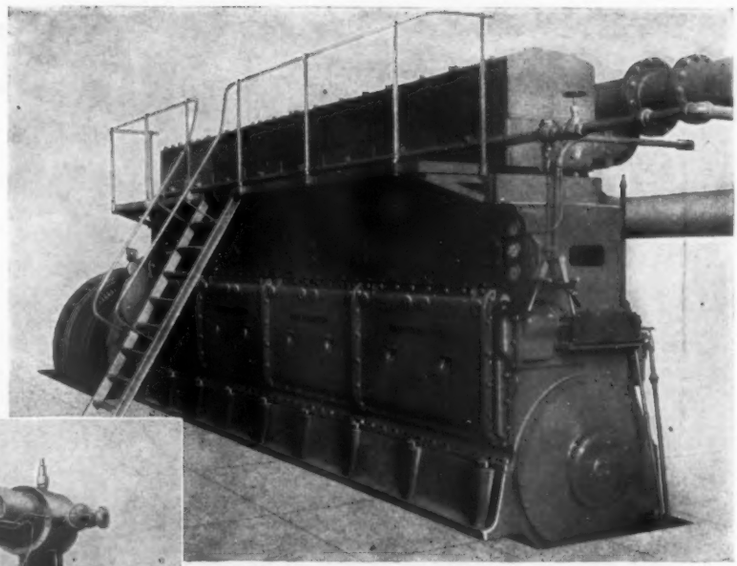
"On the contrary," was the answer, "it saves me time in the long run. By my taking each new copy home and reading it in the evenings I get a good idea of recent developments in our field. After I have finished this reading I bring the copy to the office and place it on that pile, where it remains until I am in the market for something. Then I take up these magazines and read in the advertising pages what the manufacturers say about their products. I form an idea of what I want and give time only to the firms whose products are more likely to interest me. In this way, a careful reading of the advertisements saves me time and in many instances real money.

* * *

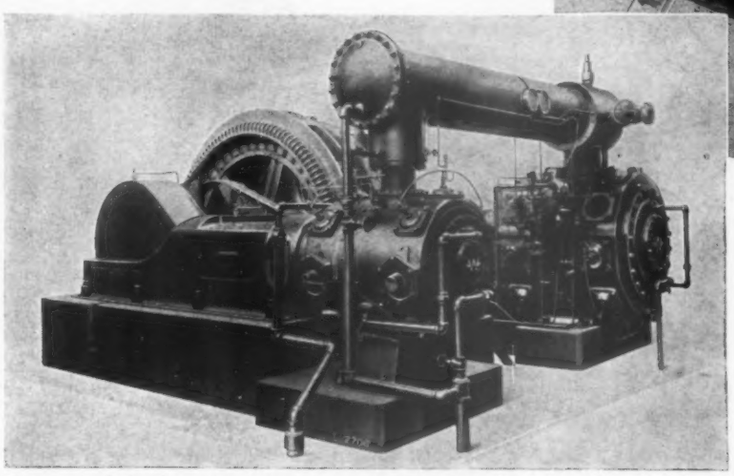
Is there not a thought here for the readers of all business papers —or more specifically for the readers of **PIT AND QUARRY?** If we save and file our read copies of this magazine we have a buying guide, which is not duplicated in book form.

The days are coming when we will want to buy. It will then be a simple matter to turn to the advertising section of the saved copies, and address inquiries only to those who seem to have what we want and within our price range.

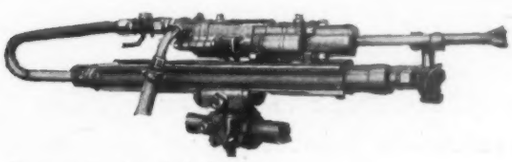
WORTHINGTON EQUIPMENT *for the* ROCK PRODUCTS INDUSTRY



1000-hp. 8-cylinder Diesel engine... totally enclosed. Worthington Diesel sizes range from 25 to 1500 hp. Any type of drive



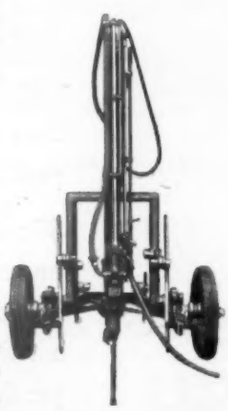
Horizontal duplex air compressor. A complete line... a wide variety of arrangements... for the largest or smallest capacity requirement



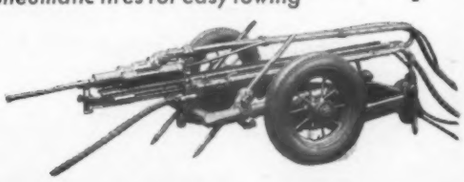
Pneumatic-feed drifter

Screw-feed drifter

Rock hammer



The ROCK MASTER... drills at any angle. Steel rims... or pneumatic tires for easy towing



THE strenuous services encountered in the rock products industry call for equipment of more than ordinary stamina.

The equipment shown here illustrates but a small part of the complete Worthington line... one which has earned an enviable reputation among users for delivering full performance and for standing up under the severest conditions.

Each unit embodies the correct engineering, high-grade materials and careful workmanship for which Worthington is widely known.

To specify Worthington is to be assured of an extra measure of protection against production delays.

ONE MAKER... UNDIVIDED RESPONSIBILITY

• *Literature available*

WORTHINGTON PUMP AND MACHINERY CORPORATION

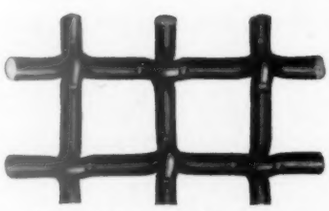
General Offices: **HARRISON, NEW JERSEY** • *Branch Offices and Representatives in Principal Cities throughout the World*

WORTHINGTON

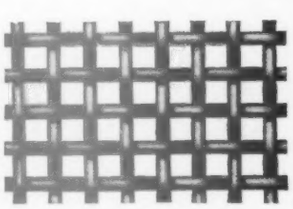
ATLANTA BOSTON BUFFALO CHICAGO CINCINNATI CLEVELAND DALLAS DENVER DETROIT EL PASO HOUSTON KANSAS CITY LOS ANGELES NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH ST LOUIS ST PAUL SAN FRANCISCO SEATTLE TULSA WASHINGTON

C7-7

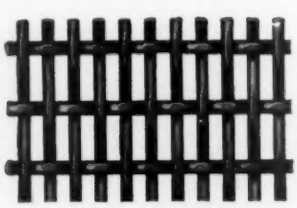
IS YOUR SCREEN PROBLEM A *TOUGH NUT* TO CRACK?



"HY-LO" Crimp Wire Screen



Square Mesh Wire Screen



Oblong Mesh Wire Screen

Efficiency? Resistance to vibration? Resistance to abrasion? What is your wire screen problem? We would like to help you lick it.

We offer you the benefit of 90 years of experience in making wire to withstand tough service conditions . . . the benefit of over a half century's experience in wire fabric production.

Roebling Wire Screens are available in many types and metals to meet a wide range of efficiency, vibration, and abrasion requirements.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, N. J. *Branches in Principal Cities*

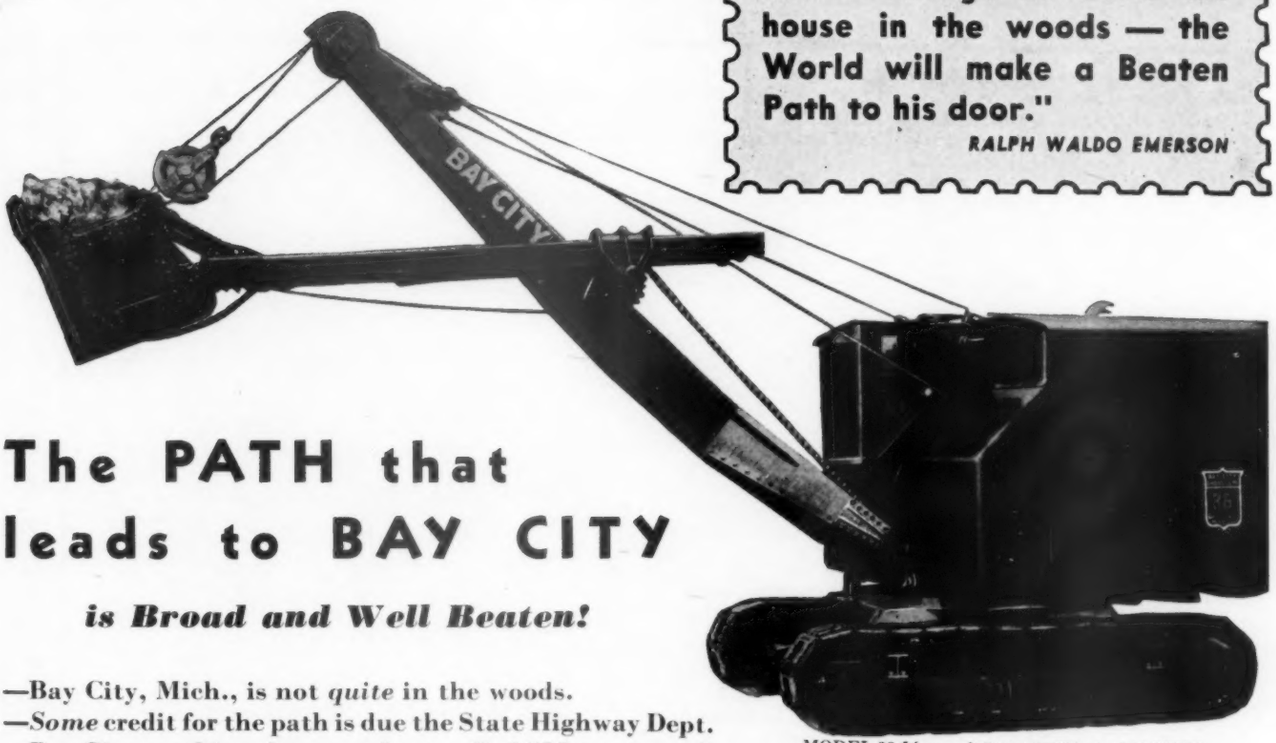
ROEBLING *Wire Screen*

TRADE JERSEY MARK

YEARS OF WIRE MAKING SPELLS THE DIFFERENCE

"If a man can make a better Mousetrap . . . than his neighbor — though he build his house in the woods — the World will make a Beaten Path to his door."

RALPH WALDO EMERSON



MODEL 38 ⅝ cu. yd. BAY CITY—1 of 10 SIZES

The PATH that leads to BAY CITY

is Broad and Well Beaten!

—Bay City, Mich., is not *quite* in the woods.

—*Some* credit for the path is due the State Highway Dept.

—Bay City machines have *not* been called "Mousetraps."

But the signposts plainly read—"Successful and Dependable Performance."

BAY CITY owners are enthusiastic users—they do not keep their good judgment secret. They tell others Bay City machines perform better, more efficiently and economically than any other shovel they have ever owned. They are repeat buyers—not stampeded by high-pressure selling, but *select* what they think most desirable in design and performance.

When they select—they BUY BAY CITY.—

And buy with confidence.

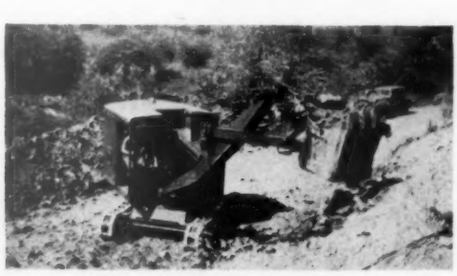
BAY CITY is completing the biggest sales volume in its history. There is a reason . . . Ask us—we'll give you the evidence . . . Ask a Bay City Owner—or better still, join the growing list of Bay City users and experience new heights of equipment satisfaction.

10 Models—⅜ yd. to 1¼ yd.

Sensibly Designed—Honestly Advertised—Fairly and Moderately Priced.

25 REASONS FOR CHOOSING BAY CITY

1—Convenient economical weight.
2—Helical cut gears—noiseless, long wearing.
3—Unit (nickel-manganese) car body and machinery table, totally heat treated.
4—Frictionless bearings thruout.
5—6-cylinder power.
6—Extra large diameter swing roller-path.
7—Oversized clutches & brakes.
8—Drop forged crawler shoes.
9—Long crawlers—low bearing pressure.
10—Chain crowd with automatic adjustment.
11—Swing lock—in any cab position.
12—Automatic Travel lock.
13—Extra heavy cab. Plenty inside working room.
14—Fast operating speeds.
15—Two travel speeds.
16—All steel construction.
17—Three lever control.
18—E-Z clutch control.
19—High pressure lubrication thruout.
20—Safety worm boom hoist.
21—Separate hoist drums.
22—Internal swing teeth.
23—Unequalled steering at full speed.
24—Convertible—without machinery change.
25—Accessibility for inspection or adjustment.



Recent Quantity Purchasers: 8 Model 20's State of N. Y. Dept. of Pub. Wks.; 8 for New Zealand Pub. Wks. Department.

Send for details

BAY CITY SHOVELS Inc. (Eastern Offices, Roselle, N. J.) **BAY CITY, MICH.**

BOOKS FOR YOUR LIBRARY

USE THIS CONVENIENT COUPON

Pit and Quarry Handbook (including the Directory of Cement, Gypsum, Lime, Sand, Gravel and Crushed-Stone Plants). 1936 ed., 792 pages, 8½ x 11½, 447 ill., 39 charts, 94 tables, cloth. Complete, concise and conveniently arranged technical reference work on all phases of designing, operating and maintaining nonmetallic-mineral producing and manufacturing plants (cement, lime, gypsum, sand-and-gravel, crushed-stone, aggregates-bituminizing and ready-mixed-concrete). Accepted the world over as the standard authority.

Pit and Quarry Directory. (The Directory Section of the Handbook, published separately). Complete alphabetical and geographical lists of nonmetallic-mineral producing and manufacturing companies and their plants. 1936 ed., 254 pages, 8½ x 11½, paper.

Cements, Limes and Plasters. By Edwin C. Eckel, C.E. Third edition, 699 pages, 6x9, 161 figs., 269 tables; cloth. A complete and comprehensive review of the raw materials, methods of manufacture and properties of the finished product, of all kinds of cementing materials used for construction.

Portland Cement. By Richard K. Meade. Third edition; revised and enlarged; XII+707 pages, illustrated. The composition, raw materials, manufacture, testing and analysis in the Portland cement industry.

Non-Metallic Minerals. By Raymond B. Ladoo. 686 pages, 6x9, 50 diagrams. A comprehensive book on the composition and properties, methods of mining and preparation, market values, extent and nature of markets, specifications and tests and uses of all non-metallic minerals of commercial importance, except fuels and natural bitumens and hydrocarbons.

The Pneumonokonioses (Silicosis) Literature and Laws of 1934. International abstracts, extracts and reviews of the pneumonokonioses and their associated diseases and subjects. By George C. Davis, M.D., Ella M. Salmonsen and Joseph L. Earlywine. 490 pages, 6x9, cloth.

Mining Engineers' Handbook. Compiled by a staff of specialists; Robert Peele, editor-in-chief. Second edition. For engineers concerned with the development and management of mines, and those interested in the construction details involved in the installation of plants. Covers mining and metallurgy, and allied subjects necessary to the mining engineer, and such data on machinery, power plants, electric transmission and structural design as he may need in the field.

A 2-volume edition is published for greater facility in field use.

Mineral Deposits. By Waldemar Lindgren, Professor of Economic Geology, Massachusetts Institute of Technology. Third edition; 1049 pages, 6x9; 313 ill. A description, by classes and type examples, of the occurrence, structure and origin of the principal deposits.

Diesel Engines. By Lacey H. Morrison. 598 pages, 6x9; 385 ill. Describes the various forms of Diesel engines now available, explains their construction and operation, tells how to keep them running in good condition and how to install them. Actual operation costs of Diesel engines now in use in various industries are included.

The Stone Industries. By Oliver Bowles, Supervising Engineer, U. S. Bureau of Mines. Covering the building-, decorative-, and crushed-stone industries in all their ramifications. It describes rocks and covers the geology and distribution of developed deposits in every state. It embraces the qualities of stones, their uses, methods of quarrying and manufacture, and marketing.

Excavation Machinery, Methods and Costs. By A. B. McDaniel, Principal Engineer, Construction Division, U. S. Army. 530 pages 6x9; illustrated. A complete handbook on excavating in mines, pits and surface workings.

Diesel Engineering Handbook. Edited by L. H. Morrison, editor of "Diesel Power." Contains more than 800 pages devoted to the history of the development of the Diesel engine, and descriptive matter concerning the many models now on the market. Profusely illustrated.

The Properties of Silica. By Robert B. Sosman. A monograph on silica in its various phases and transformations, discussing its structure and symmetry, its thermal and mechanical energy, its electric and magnetic properties, and its uses and applications in industry. 856 pages.

Bearing Metals and Bearings. By W. M. Corse. 383 pages, illustrated. A survey of the fundamental principles and practices involved in the selection of bearings and bearing metals.

Standard Practices (for Diesel-engine owners and operators). Official publication of the Diesel Engine Manufacturers' Assn. Fifteen chapters discussing construction, operation, costs, performance, fuel and lubricating systems, generators and other electrical equipment, etc.

ORDER BLANK

Book Department, Pit and Quarry Publications, 538 S. Clark St., Chicago

Enclosed find remittance for $..... for which please send the books checked below.

	Book Only Postpaid	*With 1-Year Subscription to Pit and Quarry
Pit and Quarry Handbook (including Directory)	☐ $10.00	☐ $10.50
Pit and Quarry Directory (published separately)	☐ 10.00	☐ 10.50
Cements, Limes and Plasters	☐ 7.00	☐ 7.50
Portland Cement	☐ 10.00	☐ 10.50
Non-Metallic Minerals	☐ 6.00	☐ 6.50
Mining Engineers' Handbook, in one volume	☐ 10.00	☐ 10.50
Mining Engineers' Handbook, in two volumes	☐ 12.00	☐ 12.50
Mineral Deposits	☐ $6.50	☐ $7.00
Diesel Engines	☐ 5.00	☐ 5.50
The Stone Industries	☐ 5.00	☐ 5.50
Excavation Machinery, Methods and Costs	☐ 5.00	☐ 5.50
Diesel Engineering Handbook	☐ 5.00	☐ 5.50
The Properties of Silica	☐ 9.50	☐ 10.00
Bearing Metals and Bearings	☐ 5.25	☐ 5.75
Standard Practices (Diesel engines)	☐ 2.00	☐ 2.50
The Pneumonokonioses (Silicosis) Literature and Laws of 1934	☐ 7.50	☐ 8.00

NOTE: * Rates are for North America (except Canada), South America and U. S. Possessions; for other countries, including Canada, add $1.00 per year for extra postage and duty.

Your Name..... **Title** .....

Firm Name..... **Address** .....

A LITTLE COPPER GOES A *Long Way*

YOU expect roofs made of galvanized sheets to last longer than roofs of uncoated steel, for galvanizing is the process which coats steel sheets with pure zinc.

Similarly, paint helps preserve a galvanized roof. But the basis of a steel roof is always the steel. Paint may wear off: it's the *steel* that must finally stand the buffetings of all sorts of weather.

That is why we developed USS Copper-Steel Black and Galvanized Sheets for industrial roofing. Our tests, and those of unbiased experts, have shown that a fraction of 1 per cent of copper added to molten steel more than DOUBLES THE LIFE OF THE STEEL.

And, because we have modern mills, well-equipped testing laboratories and skilled workmen, we can supply you with USS Copper-Steel Sheets at a slight increase in cost over ordinary steel sheets, without copper.

The next time you have a roofing job, specify USS Copper-Steel Sheets for the best material at the lowest cost. Our engineers, who have studied atmospheric corrosion and how to fight it, will be glad to give you the benefit of their experience.

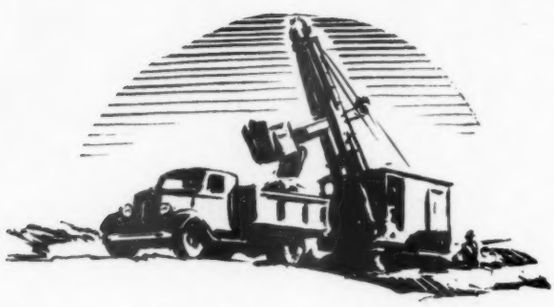
U·S·S BLACK *and* GALVANIZED SHEETS

CARNEGIE-ILLINOIS STEEL CORPORATION · *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY · *San Francisco*
TENNESSEE COAL, IRON & RAILROAD COMPANY · *Birmingham*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

3 GREAT TIRES FOR DUMP TRUCKS!



Let your work decide your tread.

Any one of these three Goodyear Truck Tires will give you the long, trouble-free service for which Goodyears are famous wherever dump trucks work. Each one has a body of patented Pre-Shrunk Supertwist Cord . . . chemically-toughened rubber . . . blowout protection in *every* ply.

For ordinary all-around dump truck service—where you don't know just what the jobs ahead may be, and if you use high pressure tires — pick the All-Weather Dump Truck Tire (1).

If you're banging over loose rocks, plowing through sharp stone—jobs where cutting and jagging and tread-ripping ruin you—pick the Pneumatic Lug Tire (2).

If you're in sand or sloppy going most of the time—where slipping and spinning and lost traction are costing you money—put on the Sure-Grip (3).

Tell your Goodyear dealer what your dump trucks do, where they work. He'll show you the ace Money Saver.

THE GOODYEAR TIRE & RUBBER COMPANY, INC., AKRON, OHIO

GOODYEAR

TIRES FOR DUMP TRUCKS

JUL -2 1937

©CIB 341887

PIT AND QUARRY

Vol. 29 FEBRUARY, 1937 No. 8

CONTENTS

News of the Industry....45
Editorial: Business and States' Rights....48
Legislation, Operating Problems Occupy Attention of Producers at Crushed-Stone Convention....50
One-Man Control a Feature of this Ready-Mixed Plant....61
Warner Co. Making Deliveries from Second Lime-Putty Plant....63
Concrete Industry Meets in Chicago....65
Separate Quarry Level Serves Lime Plant of Lawrence Portland Cement Co....67
Handling Cement and Aggregate on Lakes-to-Gulf Waterway Lock....71
The Quaternary System (CaO-Al_2O_3-SiO_2-Fe_2O_3) and the Lime-Saturation Index of Portland Cement....73
Illinois Quarry Abandons Rail Haulage, Adopts Motor Trucks....79
Damaged Cast-Iron Crusher Head Replaced with Welded Plates....81
Probable Effect and Scope of Legislation Pending in Congress....83
Personal Mention....85
Foreign Developments....87
Traffic News Digest....90
Occupational Diseases and the Law....92
New Machinery and Supplies....94

MEMBER AUDIT BUREAU OF CIRCULATIONS

Published on the tenth of each month for producers and manufacturers of Cement, Crushed Stone, Gypsum, Lime, Sand, Gravel and other nonmetallic minerals. Copyrighted 1937 by Complete Service Publishing Co., 538 South Clark Street, Chicago, Ill.

H. W. BAUMGARTNER
President

STANLEY A. PHILLIPS
Vice-President and Directing Editor

Field Editor:
W. E. TRAUFFER

Assistant Editor:
HARRY F. UTLEY

News Editor:
CHARLES MARTIN

Circulation Manager:
W. T. KLUSSMAN

Advertising Manager:
JAMES E. MONTGOMERY
Telephone HARrison 9357
Chicago, Ill.

Eastern Advertising Manager:
W. A. BUSCHMAN
Room 420, 122 East 42nd St.
Telephone CALedonia 5-4438
New York, N. Y.

Central Advertising Manager:
W. H. SANDERSON
Telephone HARrison 9357
Chicago, Ill.

Field Representative:
A. C. PETERSEN

UP...

while O.C.* goes down—

*OPERATING COST

Up . . up . . to ever increasing tonnage records in materials handling. That's part of the story of HEWITT conveyor belts. The other part is found wherever costs are checked. Here is established the *proof* that HEWITT conveyor belts lower operating costs. For in back of the production of all HEWITT industrial rubber goods is that main purpose . . . to add extra stamina and sturdiness, to build in longer life, to the end that *YOUR* operating costs may be lowered. Wherever your plant is located, a nearby HEWITT distributor will welcome the chance to prove the wisdom of a switch to HEWITT hose and belting. He is listed in the classified telephone directories of major industrial centers under "Rubber Goods" or "Belting".

HEWITT
RUBBER CORPORATION
BUFFALO, NEW YORK

HOSE • CONVEYOR AND TRANSMISSION BELTS • PACKING

Start Work on New Texas Cement Plant

SITE ON HOUSTON SHIP CHANNEL

Construction was scheduled to start Jan. 15 on a new Portland-cement plant costing $400,000 on the north side of the ship channel at Houston, Tex., according to D. J. Morse of the recently-formed Gulf Portland Cement Co.

The Gulf company is headed by Kent B. Diehl of Dallas, Tex., formerly with the Dewey Portland Cement Co. T. B. Douglas, another former member of the Dewey organization has been retained as technical manager.

According to Mr. Morse, the new plant will be strictly modern in every respect and will have a capacity of 600 bbl. of Portland cement and 300 bbl. of masonry cement per day. The wet process will be employed and oyster shells, brought up the channel by barge from the gulf coast, will be utilized as raw material.

Included in the equipment, according to Mr. Morse, will be a 220-ft. kiln, a 6-ft. by 60-ft. cooler, 5-ft. by 22-ft. tube-mills, six blending tanks 12 ft. by 28 ft. in size and one 20-ft. by 26-ft. blending tank, a No. 85 Kominuter, a Type B Jeffrey hammer-mill and five concrete storage silos.

Automatic weighing devices will be used throughout and special attention is to be paid toward obtaining accurate control on the raw side, with intensive P_h control of the hydrogen ion content of the slurry.

Actual operation is expected to start about June 1, Mr. Morse states.

Slag-Industry's Leaders Gather at Washington

Representatives of the companies that handle 85 per cent. of the annual tonnage of crushed and screened blast-furnace slag produced in the United States attended the annual meeting of the directors of the National Slag Assn. held at Wardman Park Hotel in Washington, D. C., on January 7 and 8.

The sessions represented the most satisfactory meeting that the group ever held in the 18 years of its history.

The following officers were elected:

President: H. N. Snyder, Buffalo Slag Co., Buffalo, N. Y. Vice-President: C. E. Ireland, Birmingham Slag Co., Birmingham, Ala. Secretary-Treasurer: H. J. Love, Washington, D. C.

Dewey to Operate Fleet of 12 New River Barges

The Dewey Portland Cement Co. is preparing to operate a new fleet of barges on the Mississippi River this year, according to D. M. Tyler, vice-president.

Twelve steel barges have been built by the St. Louis Shipbuilding & Steel Co., St. Louis, Mo., each having a capacity of 2,000 tons. Coal from the southern Illinois fields will be carried to the Linwood, Ia., plant where more than 100,000 tons are consumed annually in firing the kilns, while cement will be carried to ports downstream.

Industrial Sand Assn. Maps Rate Opposition

The Traffic Committee of the National Industrial Sand Assn. met Jan. 8 at Washington, D. C. The meeting was held for the purpose of formulating a definite plan of procedure by which the association will be guided in presenting to the Interstate Commerce Commission a statement of its reasons for opposing any increases in rates on industrial sand. The carriers have proposed an increase of 30 c. per ton.

★ The St. Mary's Cement Co., St. Mary's, Ont., is developing a new quarry south of its plant. Stripping is being accomplished by a large electric shovel recently purchased from the Marion Steam Shovel Co., Marion, O.

Predict Further Rise in Railway Shipments

EXPECT GAIN OF NINE PER CENT.

Conservative estimates of the Regional Shippers' Advisory Boards indicate that 23,239 more cars will be required in the first quarter of 1937 to handle shipments of cement, sand and gravel, crushed stone, lime and plaster than were loaded in the first quarter of 1936, an increase of about 9 per cent.

Sand, gravel and crushed-stone shipments will reach 194,643 carloads, according to the Boards' forecast, compared with actual 1936 loadings of 182,816 cars in the January-February-March period, an estimated gain of 6.5 per cent.

Railroad shipments of cement in the quarter will be 11.8 per cent. higher than the same quarter a year ago, an estimate of 68,908 cars having been made. In the 1936 quarter 61,654 carloads were shipped.

Movements of lime and plaster by rail are expected to gain 13 per cent., the forecast for the first 1937 quarter being for 27,483 cars compared with actual carloadings in the same period last year of 24,325.

Installs Diesel-Electric Locomotive at Hudson

★ A new 600-hp. Diesel-electric locomotive went into service a few weeks ago at the Hudson, N. Y., operations of the Universal Atlas Cement Co. The locomotive was built at the Schenectady, N. Y., works of the American Locomotive Co. This is the first equipment of this type to be used at the Hudson plant, coal-burning steam locomotives having heretofore employed.

★ The Southwest Stone Co. recently installed a 30-in. by 40-in. ring-mill, made by the American Pulverizer Co., at its plant near Chico, Tex.

Calaveras Investing $250,000 in Expansion

DETAILS OF PROGRAM ANNOUNCED

In line with the outlook for increased demand for cement on the Pacific Coast during 1937, Calaveras Cement Co. starts out the year with a plant expansion program involving the expenditure of more than $250,000.

Details of the improvements and additions that are now being installed at the company's San Andreas plant have been announced by William Wallace Mein, president, and are as follows:

A Cottrell precipitator to eliminate the dust nuisance at the plant.

A new grinding unit for finished cement production.

A Smidth dense chain system for the No. 2 kiln which will permit important fuel economies. The same installation has already been made in No. 1 kiln and has proven highly successful.

During 1936 the company built a 6-mi. haulage road connecting the plant with the high grade lime quarry; purchased a new 75 B type shovel; and installed Hummer screens in the raw mills which have effected increased production capacity for that department.

Upon the completion of the new units Calaveras will have greatly increased plant capacity, improved operating efficiency with a resulting reduction in production costs, and will be in a position to deliver in any amounts its new Pumicite (Portland-puzzuolan) cement which was recently introduced on the California market, in addition to its ordinary cement plastic and white cement products.

Industrial Power Theme of Chicago Conference

Power and its applications in industrial plants will be the theme of an all-day meeting Feb. 16 at the Palmer House, Chicago. There will be three sessions, a luncheon meeting and 18 speakers will appear on the program.

The gathering is the first of a series of five meetings sponsored by the National Power Conference. Interested executives and engineers are urged to attend.

Ideal Cement Declares Special $3.25 Dividend

A special dividend of $3.25 per share in addition to the regular quarterly $1.00 dividend was paid shortly before the end of 1936 by the Ideal Cement Co., Denver, Colo., to its stockholders.

In addition, each employee was presented with a bonus amounting to approximately 10 per cent. of his annual salary.

Provisions of Walsh-Healey Act Tightened

ADDITIONAL AMENDMENTS SOUGHT

The Secretary of Labor has amended the regulations dealing with the Walsh-Healey Act to provide for the following additional article:

"Whenever a dealer, to whom a contract within the act and regulations has been awarded, causes a manufacturer to deliver directly to the government the materials, supplies, articles, or equipment required under the contract, such dealer will be deemed the agent of the manufacturer in executing the contract. As the principal of such agent the manufacturer will be deemed to have agreed to the stipulations contained in the contract."

This is illustrative of the determination of the Department of Labor to close any possible loopholes under the Act. Amendments are being sought in the present Congress which will increase the applicability of the Act, probably by reducing to a sum of $2,000 the contracts subject to the Act. The Department of Labor also seeks substantial appropriations for enforcement of the Act, no money having been provided in the Act itself.

Numerous Cement Plants Install New Coal Mills

★ A number of B & W coal mills have gone into service in Portland-cement plants recently. Installations included the Irwin, Wash., plant of the Spokane Portland Cement Co.; the Bellingham, Wash., plant of Olympic Portland Cement Co., Ltd.; and the East Fultonham, O., plant, Columbia Cement Division, Pittsburgh Plate Glass Co.

The Hudson, N. Y., plant of the Universal Atlas Cement Co. and the Spokane plant mentioned above also installed B & W raw-grinding mills a short time ago.

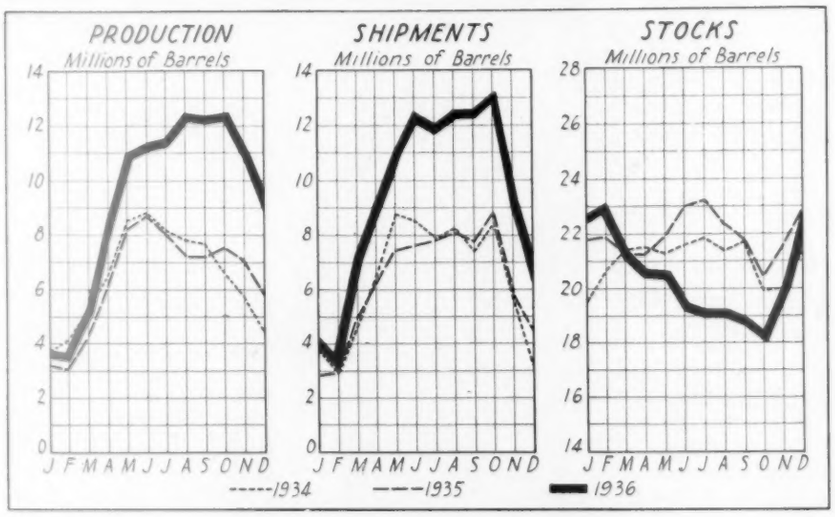
New Colorado Feldspar Plant Ready in Spring

Machinery is being installed preparatory to operation this spring of the new $100,000 Canon City, Colo., plant of the Colorado Feldspar Co.

Raw material will be obtained locally in Fremont County.

★ The Foxburg Silica Co. has installed a 24-in. by 36-in. Type B Buchanan crusher at its mine located near Foxburg, Pa.

CEMENT SHIPMENTS UP 48.8 PER CENT. IN 1936



The Portland-cement industry in December, 1936, produced 8,971,000 bbl., shipped 6,246,000 bbl. from the mills, and had in stock at the end of the month 22,842,000 bbl. Production and shipments of Portland cement in December, 1936, showed increases of 54.6 and 38.4 per cent., respectively, as compared with December, 1935. Portland-cement stocks at mills were 0.5 per cent. lower than a year ago. The preliminary totals of production and shipments for 1936 show increases, respectively, of 45.7 and 48.8 per cent. over the final totals for 1935. Production in 1935 was 76,472,000 bbl.; in 1936 it climbed to 111,815,000 bbl. Shipments in 1935 were 74,934,000 bbl.; in 1936 they were 111,977,000 bbl.

Fleming Named P.C.A. Manager at New York

FAIRMAN JOINS PENN-DIXIE CO.

E. M. Fleming has been named regional manager of the eastern offices of the Portland Cement Assn., succeeding J. R. Fairman who has resigned to become vice-president of the Pennsylvania-Dixie Cement Corp.

Except for a brief period during the war, Mr. Fairman had been with the Portland Cement Assn. for over 16 years, starting as a fieldman in Kansas City, then district engineer at Birmingham, Ala., regional manager at Atlanta and finally regional manager in charge of the eastern offices at New York.

Mr. Fleming has had an almost equally well rounded out record of experience with the association. He started as a fieldman in the Indianapolis office, assigned to special duties, later assuming similar responsibilities in the Highways Bureau at Chicago headquarters. He was later made manager of the Highways Bureau, and at the request of Mr. Fairman, was transferred to the New York office as district manager. His success in the latter job, coupled with his broad experience in association work, made him the logical choice to succeed Mr. Fairman.

Universal Atlas Expands Leeds Building Program

Foundations are in at the new wet-process plant of the Universal Atlas Cement Co. at Leeds, Ala., and work is proceeding on a larger scale than originally planned. The company will expend approximately $2,500,000 in rebuilding the old mill and on new construction and equipment, it is reported.

Moves Gravel Equipment to New Location in N. J.

The A. D. McKee Co. Inc., aggregates producer at Hohokus, N. J., has dismantled its operation at that point and is erecting a new and modern plant at Mawah, N. J. The new plant, according to Mr. McKee, will have a capacity of about 100 cu.yd. per hr., power for operating the equipment being supplied by a Diesel-driven generator.

Cement Plant in Mexico Installs Two Tube-Mills

W. B. Williams, chief engineer, Cementos Atoyac, S. A., has returned to his home at Woodland, Mich., for a short vacation after having completed the installation of two tube mills and allied equipment in the Puebla, Mexico, plant of the above company.

Carlos Manfrino has joined the organization of Cementos Atoyac, S. A., Mexico City, Mexico, in the capacity of general sales manager.

Luis Gamboa was recently made superintendent at Puebla. Other officials of the company are F. J. Miller, president; Alton J. Blank, general superintendent and supervising chemist; W. B. Williams, chief engineer; John A. Blank, consulting chemist; E. A. Linares, asst. superintendent; and Daniel Vega, chief chemist.

Southwestern Erects 5 More Silos at El Paso

★ Five reinforced-concrete storage silos, each 25 ft. in diameter and 80 ft. high have been erected at the El Paso, Tex., plant of the Southwestern Portland Cement Co. The work was done under contract by the MacDonald Engineering Co., Chicago.

Signal Mountain Starts Year in Optimistic Mood

The Signal Mountain Portland Cement Co. invested $71,954 for new machinery in its plant at Chattanooga, Tenn., last year; its shipments increased over 1935 by nearly one-fifth, and unfilled orders at the year-end totaled more than twice as much as at the preceding Dec. 31, John L. Senior, president, told stockholders at the annual meeting at Chattanooga on Jan. 21.

Unfilled orders on the books Dec. 31 last amounted to 199,259 bbl. as compared with 73,053 bbl. at the 1935 year-end, an increase principally due to the activities of the Tennessee Valley Authority.

All the officers and members of the executive committee were re-elected at the meeting.

Erect 9 Lime Kilns as Virginia Relief Project

Nine shaft kilns for the production of lime are being erected in Giles County, Va., as a drought relief project, according to press reports. More than 100 workers are engaged in the project, it is said, and firing of the kilns is expected to get under way in the spring.

★ Norblo dust-collecting systems are to be installed in the sixteen plants operated in the east by the General Crushed Stone Co. The equipment will be supplied by the Northern Blower Co., Cleveland, O.

A.S.T.M. Committees to Meet in Chicago

REGIONAL MEETING MARCH 2-3

Two technical symposiums, one on lubricants and the other on corrosion testing, are to be the features of the 1937 A.S.T.M. regional meeting to be held at the Palmer House, Chicago, March 2 and 3. The symposium on corrosion testing is scheduled for the evening of March 2, while the symposium on lubricants will involve two sessions, morning and afternoon on March 3.

The Regional Meeting is being held during A.S.T.M. Committee Week when some 100 meetings of the Society's committees will be held. At their meetings, the committees will review their research programs and discuss existing specifications and tests and consider new standards which are in course of development.

Louisville Stone Firm Effects Reorganization

Reorganization of the Kentucky Consolidated Stone Co., Louisville, Ky., which had been operating in receivership for some time has been effected. The new concern is known as the Kentucky Stone Co. and is continuing to operate the nine quarries and plants. Sam P. Burnam, formerly trustee under the receivership is now president, Verne C. Morgan is secretary-treasurer, and Thomas B. Bullitt is vice-president. Wiley B. Bryan is chairman of the board.

No Winter Lay-Off at Petoskey Cement Plant

Employees of the Petoskey Portland Cement Co. at Petoskey, Mich., have been assured by Supt. J. L. Galster that they will not be forced to take the usual winter lay-off this year. Although production is being halted during the month of February all employees will be carried on the payrolls and will be used to make repairs and alterations at the plant.

Issues Dredging Permit to Core-Sand Producer

The Michigan Department of Conservation, Lansing, Mich., has issued a lease-permit to the Bridgeport Core Sand Co., Saginaw, Mich., allowing it to take sand from Lake Huron and Saginaw Bay.

Editorial

Business and States' Rights

ONE of the disadvantages of a federalized government is evident in the tenacity with which certain people, chiefly politicians, cling to the theory of states' rights. Although we have not heard much on this subject since the political decision of last November, it still serves as a convenient peg on which to hang claims for special privileges of a local nature and the cloak of general opposition to every new proposal aimed to improve the public welfare. There is really nothing strange in this, because the question of states' rights was a fundamental one in the amalgamation of the thirteen colonies and it is still relied upon as a sure rallying point for those whose vision does not extend far, if at all, beyond the sphere of self-interest. Political autonomy, which is the nucleus of the states' rights philosophy, can be carried to any extreme from the empire of a Caesar to the stamping ground of the precinct committeeman, and even after it has outlived the season for its original existence it continues to render service as the battle cry of regionalists of the narrowest views.

The political aspects of the states' rights philosophy are less important than they were when the nation was established, much less important than they were when the nation was threatened with dismemberment. Its social and economic aspects have come into the foreground, and its proponents, with a dexterity that could well be employed in a better cause, are trading upon its outworn political significance in order to further non-political aims. It is being utilized not only to obstruct political progress and efficiency, where these can be most effectively advanced by centralized action, but it serves as the irritation-point at which organized opposition to public-welfare measures can be focused. As a result, almost every effort on the part of the federal government designed to improve conditions affecting the entire population or large sections of it is met with an emotional outburst about the usurpation of states' rights or a pseudo-logical appeal to what the pleaders flatteringly address as the "thinking" people. States' rights has become a handy tool for frustrating attempts to accomplish advance in a national sense and has become more conspicuous in this use than as a means for improving the condition of individual states or for protecting what are conceived to be their peculiar privileges.

This opposition to centralized action of national scope has shown itself in numerous important cases, wherein different classes whose interests are normally opposed or at least unlike joined hands. The defeat of national prohibition was due more to the coöperative opposition of poor and rich than to the logical appeals of reformers. Certain religious groups, who were at first concerned only about the status and future of their schools in a country pledged to religious liberty and a school system free from sectarian bias or influence and therefore opposed national education, have naturally fallen into a position in which they oppose all proposals for national action in the remedying of social and economic ills. The proposal to abolish child labor by constitutional amendment submitted by Congress in 1924 failed of adoption because of such emotional survivals of what were once reasons of real significance.

THE absurdity arises from the fact that political boundaries, which are the delimiting factors in the assertion of states' rights, are arbitrarily drawn and bear no relation whatever to the economic, intellectual, social or cultural conditions or problems of the people who live on either side of them. The corn belt crosses many state lines; hardly any type of important industry is confined to a single state either in the source of its raw materials, financial means or labor or in the distribution of its products; no natural resources coincide in their physical boundaries with those of any political subdivision; the rain falls as heavily, the lightning strikes as forcibly, flood-waters flow as menacingly, erosion acts as certainly, on one side of a state's line as on another. Except for a state-line sign, a possible difference in the type of pavement, and an almost certain difference in the gasoline tax rate, one may motor from one state into another without being aware that he has passed from one political entity into another; that although he is considered a married man in the one, he is legally a single man in the other; that although he may lawfully buy intoxicating liquors in the one, he may not do so in the other; that although he may lend money at seven per cent. in the one, he may not ask more than six per cent. in the other; that although he may attend the cinema on Sunday in the one, he can not do so in the other. These are but a few of the hundreds of absurdi-

ties into which an insistence upon states' rights has thrust a people who pride themselves upon their astuteness, their efficiency, their practicality. We tolerate these things—their illogicality, their inconvenience, their frightful expense—largely because they gratify our sense of exclusiveness, our desire to be identified with a small and select group to which those across the border or outside the pale shall stand in the position of foreigners. What is one of the most alarming features of our endurance—not to say our approval—of these incongruities is the seeming indifference with which we pay for their expense—the cost of administering forty-eight state governments, more than three thousand county governments, and many more thousands of city, town and village governments, which each year entrench themselves more deeply in the social fabric and the customs of the nation.

ASIDE from the politicians, who revel in a multiplicity of jobs and in the complexities of government, what remains of the theory of states' rights is most ardently championed by those who have special interests that must be protected or expanded. These provide us with senatorial advocates of silver coinage, tariff protection for special products, government subsidies for new industries that have a highly localized raw-material, labor or taxation problem, and the like. In such matters they seek and insist upon national action. They give us, too, those who plead for the handling through state legislatures of child labor, factory inspection, occupational accidents and diseases, and other problems which bear no relation whatever to political boundaries. In such matters they insist upon local action. When they require broad protection, they implore the aid of the federal government; when they have reason to fear restraining influences, they set up the "local nature" of the problem as a reason for state consideration and state legislation. So it happens that what are really local, special, sometimes purely individual problems become matters of national discussion, excitement and concern, whereas problems that are actually of great national importance, such as unemployment, poverty, mass purchasing power, industrial relations, ethical conduct, social relations, and so on, are treated as subjects of only local interest.

Forty-eight independent social-science laboratories for the trial-and-error method of testing the soundness of proposed economic and social reforms is the grandiose phraseology in which some modern defenders of the states' rights philosophy describe and attempt to justify the present system. Forty-eight separately organized, differently directed agencies who may, but are in no sense bound to, study what might be called the "neighborhood segments of a nationwide problem" and who may, but seldom do, arrive at any worth-while or reasonably permanent solutions. Forty-eight legislatures which, because they are composed of men who are pledged to, and are often themselves personally interested in, the preservation of established privileges or in the *status quo,* can not see a national problem in its truly national aspects and can not, because of the local applicability of the measures they enact, accomplish anything of great importance. Lack of coördination makes their efforts, however well-intentionad and well-informed, utterly ineffective in the solution of national problems, yet they continue to insist upon their prerogative to attack the problems of a nation piecemeal by the methods of the ward politician. The picture is one of petty governments and locally subservient legislators playing with human destinies in matters that affect the whole nation, while we are urged to avoid the means which, were it not for a narrow insistence upon a respect for states' rights, could be made quickly and less-expensively available.

There are few if any economic, social, cultural or moral rights possessed by either individuals or corporations that are restricted, except in custom, by the boundaries of individual states. Yet these artificial limits, created by the politician and preserved by him and the graphic art of the cartographer, hamper a great nation in advancing the interests of its citizens. They have given us the ever-present problem of interstate and intrastate commerce, they have complicated the system of taxation and forced business to move from one state to another to escape injustice, they have set up many different standards of conduct for the individual and the corporation, they have made possible the control of public servants by small groups of special interests, they have multiplied many times the cost of performing the necessary functions of government. They have made it necessary for the federal government to initiate and carry through certain activities on a national basis, because defects in administrative machinery, due principally to the present system of federalism, made it impossible for the states to accomplish individually what the national government could do so easily and economically.

THE great majority of business men are more deeply affected by this problem of states' rights than they probably realize. They seek no privileges that they are not willing to share with other business men including their competitors; hence, they have no selfish reason for insisting upon the preservation of state autonomy and the prerogative of state legislatures. If they are anxious to maintain the right of reasonably free competition and to exclude from business dealings practices that restrict or prevent the exercise of that right, they have less to fear from business regulations imposed by a national government than from those set up by state governments. There is safety in numbers, and the government that is compelled to consider the interests of great masses of people and of many different groups and classes is much less likely to favor special interests or to act to the detriment of the public interest than is a government that has been set up by, and depends largely for its continuance in office on the placating of, what are local, and almost certain to be special, interests. The states' rights theory has been losing ground for years, but its passing is occurring more rapidly now, under the pressure of national needs and the inability of the states to meet them, than at any other time since the founding of this nation.

Legislation, Operating Problems Occupy Attention of Producers at Crushed-Stone Assn. Convention

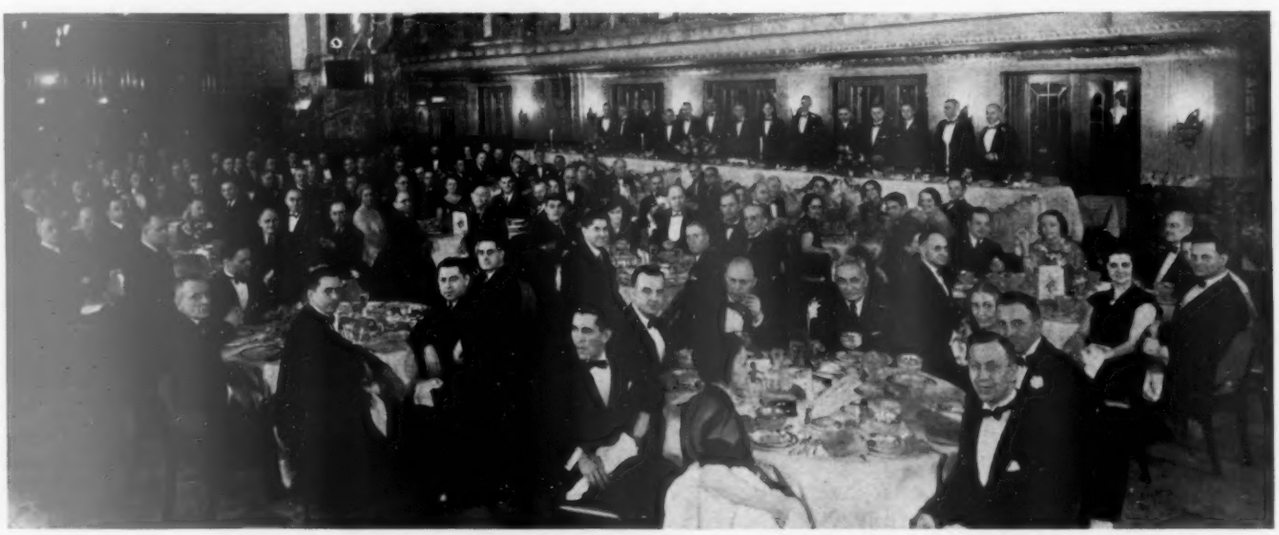
PRESENT and proposed federal legislation affecting business received much of the attention of the more than one hundred producers who attended the twentieth annual convention of the National Crushed Stone Assn. The meetings were held in the Netherland Plaza Hotel, Cincinnati, January 18 to 20, and were preceded and followed on Jan. 17 and 21, respectively, by the meetings of the old and new boards of directors.

President H. E. Rodes presided at the Monday morning opening session which was devoted entirely to association business and reports. The *Reports on Business Conditions* by regional vice-presidents brought out the facts that the crushed-stone industry in 1936 experienced a substantial increase in business and that there was also some increase in prices. That there is ample room for further improvement was indicated by the fact that less than half of the existing plant capacity was utilized. Further increases in the volume of business and in price levels for 1937 are expected in most sections. Government competition with private industry has been negligible except in a few localities. The vice-presidents reporting were unanimous in recommending that the research facilities of the association be increased so that more work can be done on new outlets for crushed stone and so that members can be advised on their individual operating problems.

T. J. Weston, president, Weston & Brooker Co., Columbia, S. C., reporting for the states of Tennessee, North Carolina, South Carolina and Georgia, said that production and sales in 1936 were from 20 to 89 per cent. higher than in the previous year. Price increases ranged up to 20 per cent. and production averaged about 60 per cent. of plant capacity. From 65 to 75 per cent. of the product was used for roads, 10 per cent. for railroad ballast and 10 per cent. for building construction. Production and prices in 1937 are expected to be the same or higher in these states and the percentage of distribution will be unchanged. According to Mr. Weston, government competition is serious only in western Tennessee and portable-plant competition is increasing in North Carolina.

Several crushed-stone producers in Iowa reported that both production and prices were higher in 1936 and that continued improvement is expected. Most of the material produced was used for road work and W.P.A. buying was an important factor.

J. A. Rigg, treasurer and general manager, Acme Limestone Co., Fort Spring, W. Va., said that production and prices had improved in 1936 in his territory and that further improvement is expected in 1937. About 40 per cent. of the industry's plant capacity was utilized. The distribution of the product was about as follows: Highways 40 per cent.; railroad ballast 20 per cent.; building construction 10 per cent.; metallurgical and miscellaneous 30 per cent. According to Mr. Rigg, these percentages will be changed to some extent in 1937, due mainly to the fact that the sales of ballast are drop-



Chas. P. Taft was the speaker at the annual banquet Wednesday evening, Jan. 20.

ping because of the growing use of ballast-reclaiming machines by the railroads. The demand in the other three classifications is expected to increase considerably. The W.P.A. in general has been a benefit to producers, said Mr. Rigg, and should continue to stimulate production. In this territory one state, which has been producing agricultural limestone with prison labor, is reported to be going into the production of aggregates as well.

Business in the Southwest increased in 1936 and prices remained stationary, according to E. Eikel, secretary, treasurer and general manager of the Servtex Materials Co., New Braunfels, Tex. The plants reporting operated at 37 per cent. of their capacity. The distribution of the product was as follows: Highways 65 per cent.; ballast 15 per cent.; building construction 10 per cent.; miscellaneous 10 per cent. Business this year will probably equal that of 1936 but a price drop is expected due partly to the increasing number of portable plants. The demand for ballast should increase but highway requirements will decline. There is a growing amount of governmental competition and W.P.A. projects have been detrimental to established producers. One of the main reasons for this rather depressing prospect, according to Mr. Eikel, is the fact that high freight rates make it impossible for permanent plants to compete with portable plants outside a very restricted area.

Mr. Boyd read the report of Porter W. Yett, president, City Motor Trucking Co., Portland, Ore. In this territory production increased 20 per cent. over 1935 and prices remained stationary. Only 35 to 40 per cent. of the industry's plant capacity was utilized and production costs increased due in part to a tightening up of specifications. Highway construction took 60 per cent. of the output; ballast 5 per cent.; building 5 per cent.; miscellaneous 20 per cent. Production and prices are expected to increase in 1937 in spite of an increase in the number of portable plants in this territory. The W.P.A. is regarded as a serious threat to established producers.

A. T. Goldbeck, engineering director of the association, in his annual report stressed the importance of research to the industry in holding its present markets and in developing new products and new uses for old products. Crushed stone, he said, is ideal for use in stabilized roads of the several types now growing in popularity and the ultimate need for bituminized seal coats to retain this stability will create an additional market.

In a more technical vein Mr. Goldbeck discussed the reasons for the varying characteristics found in similar concretes. A seemingly slight difference in the coëfficient of expansion of concrete ingredients in mass concrete, he said, often creates serious problems. In comparing sand-and-gravel concretes he said that even a slightly higher modulus of rupture of stone concrete may mean a much greater resistance to repeated rolling loads, such as those to which concrete pavement is subjected.

Mr. Goldbeck also discussed the scaling found in some concrete pavements in which stone sand is used. Some authorities blame this scaling on the crystallization of sulphides and others on the coarseness of the sand. The use of ice-removing applications is suggested as another possible reason. This subject, in the opinion of Mr. Goldbeck, deserves considerable research. In discussing wear tests he said that the Los Angeles rattler test is gaining wide acceptance and deserves further study. Results from this test have been found unusually consistent and closely simulate actual conditions.

The annual report of J. R. Boyd, administrative director of the association included a general discussion of association policies and activities, and an announcement of the auditing, resolutions and nominating committees closed this session.

NATIONAL CRUSHED STONE ASSOCIATION

1937

OFFICERS

H. E. Rodes, *President*
Nashville, Tenn.

A. T. Goldbeck, *Engineering Director*
Washington, D. C.

J. R. Boyd, *Administrative Director*
Washington, D. C.

REGIONAL VICE-PRESIDENTS

C. M. Doolittle (Canadian)
E. Eikel (Southwestern)
A. S. Lane (Eastern)
N. E. Kelb (Northern)
J. A. Rigg (Central)
T. I. Weston (Southern)
A. J. Wilson (Western)
Porter W. Yett (Northwestern)

BOARD OF DIRECTORS

H. E. Rodes, *Chairman*

W. M. Andrews, New Castle, Pa.
C. C. Beam, Melvin, O.
W. P. Beinhorn, Minneapolis, Minn.
H. E. Billman, St. Louis, Mo.
A. J. Blair, Milwaukee, Wis.
L. J. Boxley, Roanoke, Va.
J. R. Boyd, Washington, D. C.
J. Reid Callanan, South Bethlehem, N. Y.
C. M. Doolittle, Hamilton, Ont., Can.
F. O. Earnshaw, Youngstown, O.
E. Eikel, New Braunfels, Tex.
A. T. Goldbeck, Washington, D. C.
Otho M. Graves, Easton, Pa.
A. Acton Hall, Piqua, O.
George Hammerschmidt, Elmhurst, Ill.
J. L. Heimlich, Le Roy, N. Y.
W. E. Hilliard, New Haven, Conn.
C. S. Huntington, Chicago, Ill.
N. E. Kelb, Indianapolis, Ind.
E. J. Krause, St. Louis, Mo.
Max S. Lambert, Chicago, Ill.
A. S. Lane, Meriden, Conn.
Thomas McCroskey, Knoxville, Tenn.
B. A. McKinney, West Roxbury, Mass.
Paul M. Nauman, Dubuque, Iowa
John Prince, Kansas City, Mo.
W. T. Ragland, Raleigh, N. C.
H. E. Rainer, Buffalo, N. Y.
Russell Rarey, Columbus, O.
John Rice, Easton, Pa.
J. A. Rigg, Fort Spring, W. Va.
Dan Sanborn, Kankakee, Ill.
James Savage, Buffalo, N. Y.
F. W. Schmidt, Jr., Morristown, N. J.
L. W. Shugg, Schenectady, N. Y.
W. C. Sparks, Princeton, Ky.
Stirling Tomkins, New York, N. Y.
T. I. Weston, Columbia, S. C.
Harold Williams, Boston, Mass.
A. J. Wilson, Watsonville, Cal.
R. S. Wilson, Little Rock, Ark.
W. F. Wise, Dallas, Tex.
A. L. Worthen, New Haven, Conn.
Porter W. Yett, Portland, Ore.

Analysis of Attendance at the Twentieth Annual Convention of the National Crushed Stone Assn. Cincinnati, January 18 to 20, 1937

Producing companies' representatives	107
(Companies represented)	(54)
Association employees	5
(Associations represented)	(1)
Equipment-Manufacturing Companies' representatives	126
(Companies represented)	(48)
Trade-publications' representatives	7
(Trade publications represented)	(2)
Guests (including 11 ladies)	107

Large Groups in Attendance

Producers:

The General Crushed Stone Co	11
Marble Cliff Quarries Co	7
Carbon Limestone Co	5
Weston & Brooker Co	5
Acme Limestone Co	4

(Seven companies had 3 each, 12 had 2 each, and 30 had 1 each.)

Equipment Makers and Publications:

Allis-Chalmers Mfg. Co	9
Bucyrus-Erie Co	8
Atlas Powder Co	6
Hercules Powder Co	6
American Cyanamid & Chemical Corp	5
Trojan Powder Co	5
E. I. duPont de Nemours Co	4
Link-Belt Co	4
Nordberg Mfg. Co	4
Taylor Wharton Iron & Steel Co	4
Pit and Quarry Publications	4

(Twelve companies had 3 each, 11 had 2 each, and 16 had 1 each.)

At the greeting lunch Charles Sawyer, former lieutenant-governor of Ohio, spoke on the *Problems of Present-Day Business*. He said, among other things, that business for years has been utilizing and making demands on government and that now the tables are turned and government is making demands on business. He said that altered social thinking is responsible for the new attitude toward business and that new relationships between business, government and the public are inevitable.

The Use of "Stone Sand" in Concrete Construction was discussed by R. R. Litehiser, chief engineer, Bureau of Tests, Ohio Dept. of Highways, at the afternoon session with John Prince, president, Stewart Sand & Material Co., Kansas City, Mo., in the chair. The speaker referred to the early use of stone sand in concrete by his department in 1923. The fine aggregate used was designated "limestone sand" on the laboratory report and was graded down from ¼ in., with 30 per cent. passing the No. 30 sieve and 6 to 11 per cent. passing the No. 100 sieve. The material was washed. The concrete pavement made with this material is in "fair condition, though scaled to a considerable extent."

In 1928 "washed limestone screenings" were used as the fine aggregate in another concrete pavement, which shows no progressive disintegration but some scaling and spalling about most of the cracks. The material was graded down from ½ in., with 87.5 per cent. passing the ¼-in., 35 per cent. passing the No. 30, and 17 per cent. passing the No. 100 sieve. Another 1928 job, which, however, used expansion joints, "is in good condition although there has been some patching." The fine aggregate used on this job was also washed limestone screenings graded so that 97.9 per cent. passed the ¼-in., 30.9 per cent. passed the No. 30, and 7.7 per cent. passed the No. 100 sieve.

Specifications reflected the experience gained on these and other jobs, so that in the 1931 specifications it was stated that, "This description" [of the fine aggregates] "shall not be interpreted as admitting the use of limestone sand unless permission to use same is shown in the plans or in the special provisions and proposal. This washed limestone sand shall be produced from Grade A stone."

In 1933 stone stand was "admitted on an equal basis with natural sand with slightly more liberal limits on the fines." The requirements were that "not more than 7 per cent. by weight shall pass the 100-mesh sieve and not more than 4 per cent. be lost in the decantation test." For natural sand the respective limits were 5 and 3 per cent.

The speaker mentioned the Ohio State University stadium, built in 1921 and 1922 with stone sand, as an outstanding example of the type of concrete obtainable. From 1923 to 1935 inclusive the Ohio Dept. of Highways built 171 mi. (approximately 6 per cent. of the total mileage of concrete pavement) using stone sand as the fine aggregate. In 1936 this percentage rose to 20 per cent. and represented the use of 40,000 tons of stone sand on 18 mi. of concrete pavement and base.

The speaker showed a number of stereopticon slides presenting comparative data on the use of a stone sand and natural sand in concrete. The following facts were among those shown:

Stone sand weighs 90 lb. per cu. ft., natural sand 95 lb. per cu. ft.

The results of 232 tests showed 7-day compressive strengths of 2,265 lb. per sq. in. for concrete made with stone sand and 3,316 lb. per sq. in. for that made with natural sand, the coarse aggregate being limestone in all cases. The average compressive strength of 1,042 tests, including all fine aggregates and all coarse aggregates (slag and gravel as well as crushed stone), was 3,531 lb. per sq. in. at 7 days.

The 28-day compressive strengths were: stone-sand concrete 4,200 lb. per sq. in., natural-sand concrete 4,453 lb. per sq. in.; average of all concretes (including those using gravel and slag as coarse aggregates) 4,512 lb. per sq. in.

Base-concrete showed 2,300 lb. per sq. in. for stone-sand concrete, 2,750 lb. per sq. in. for natural-sand concrete, and 2,840 lb. per sq. in. for all the concretes tested at 7 days. The 28-day tests showed 3,470 lb. per sq. in. for stone-sand concrete, 4,076 lb. per sq. in. for natural-sand concrete, and 3,966 lb. per sq. in. for all the concretes tested.

Transverse-strength tests showed for pavement concrete 704 lb. per sq. in. for stone-sand concrete, 750 lb. for natural-sand concrete, and 727 lb. per sq. in. as the average for all the concretes tested at 7 days. The 28-day tests showed 642 lb. per sq. in. for stone-sand concrete, 822 lb. per sq. in. for natural-sand concrete, and a slightly lower figure for the average of all.

Ohio's specifications have been changed so that for 1937 they require 100 per cent. to pass the No. 4 sieve, 95 to 100 to pass the No. 8, 50 to 70 to pass the No. 16, 30 to 50 to pass the No. 30, 10 to 30 to pass the No. 50, and 3 to 10 to pass the No. 100.

"In arriving at the foregoing gradation correction we made microscopic and chemical examination of one concrete pavement in which stone sand was used which had disintegrated badly in two years and which continues to disintegrate at four years," said Mr. Litehiser. "This study revealed the presence of much calcium sulpho-aluminate in the concrete which is generally encountered where concrete disintegrates if there is any possibility of

sulphate action. The study further revealed that the present supply of stone sand in the quarry which produced the fine aggregate used in the job contained a considerable quantity of pyrite, an iron-and-sulphur compound. . . . The connection between soluble sulphur compounds in fine aggregate and disintegration of the concrete in the pavement mentioned seems sufficiently clear to warrant the placing of a sulphur limitation of .3 per cent. by weight of fine aggregate on all fine aggregate. This includes natural sand as well as stone sand. . . .

"Stone sand has been used extensively in the manufacture of dense graded bituminous concrete in Ohio since 1931 with very satisfactory results. During the past two years approximately 60,000 tons of stone sand have been used in the manufacture of this material by the Ohio Dept. of Highways. The tonnage amounts to approximately 50 per cent. of the total amount of sand used during the two years in dense graded bituminous concrete. The fine aggregate used in dense graded bituminous concrete is a comparatively-fine fine aggregate, graded almost identically with that now required for Portland-cement concrete."

In discussing *Methods of Preparation of Stone Sand* Joseph H. Jackson, general manager, Carbon Limestone Co., Youngstown, O., said that his company had been making stone sand for seven or eight years. Good rock is necessary and washing is essential to remove the fine particles. The latter is accomplished by the use of a sand cone, whose discharge goes to dewatering screens.

J. A. Rigg, general manager, Acme Limestone Co., Fort Spring, W. Va., who spoke on the same subject, said that as there was no market for its material under ¼ in. in size, his company thought of the possibility of selling this material in some form as a substitute for natural sand, of which there was a scarcity in his part of the country. Preliminary tests were made to determine what could be done with the material available and it was decided to produce a stone sand as good as Ohio River natural sand. The dry method was adopted because of the necessity of removing the minus 100-mesh material. The company uses a series of screens which divide the material into five sizes. These are recombined as required and the fines are removed by an air-separator. From the crusher the stone goes to a scalping screen, which takes out the spalls and fines, after which the material goes to the washing plant. The sand is made from the secondary-crusher screenings. The washed sand is put with the dry sand.

More than 90 per cent. of the stone sand produced is made by the dry method, according to Mr. Rigg. The material has been used in some of the largest buildings erected in his territory.

The most satisfactory grading, used by the Chesapeake & Ohio Railway, provides that no material shall be retained on the No. 4 sieve, 15 per cent. on the No. 8, 36 per cent. on the No. 14, 29.5 per cent. on the No. 28, 79.5 per cent. on the No. 40, and 94 per cent. on the No. 100. Mr. Rigg is of the opinion that this material "is a little coarse."

What's on the Worker's Mind Today was the subject of an interesting talk by Whiting Williams, who has studied the problems of workers by joining their ranks and working and living with them in mines, steel mills and factories in the United States and foreign countries. The speaker said labor leaders allege that the problems confronting the workers are so deep that they are needed to interpret and solve them, whereas these problems are caused by local difficulties, maladjustments arising from small details. Their solution calls for sympathetic understanding and a spirit of fairness.

It is easier now than ever before to close a plant by a strike, according to Mr. Williams. But the labor leader can not accomplish this unless he can show the workers adequate justification for strike action. The workers are really the bosses of the labor leaders, but they have not been taken seriously enough and the leaders too seriously.

Mr. Williams says that 60 per cent. of all workers want jobs regardless of the methods used to get them, 25 per cent. favor the labor union as the means, and 15 per cent. are willing to look to the employer. Many troubles arise from what the speaker called "managerial stallitis" and cited a strike of tire workers due to nothing but a 3-day delay on the part of management in answering a request for a 3 c.-an-hr. increase in pay. Another difficulty he called "foremanitis," the elevation of foreman to the rank of bosses after the discharge of a superintendent.

In answer to the question, "What makes 90 per cent. of the workers willing to go along with the minority, even if that minority is radical?," Mr. Williams offered the reply that the average worker fears the unjust loss of his job. Every worker, as the speaker explained it, is governed largely by fear in hard times, by hope in good times, and by pride at all times. Every worker fears the loss of his job, and this fear is greatest when business declines and men are laid off. Every worker wants to feel that he fills a niche in the scheme of things, that he is important because what he can do is important, and he can prove this to his own satisfaction only by holding a job. Every worker hopes to improve his condition, to better his opportunities, and this hope is greatest when business improves and the demand for his services increases.

"Have we done everything possible to reduce fear on the part of our workers?" asked Mr. Williams. "Have we eliminated favoritism? Have we insured regularity of employment?

"Have we done everything possible to justify the worker in taking pride in his work? Have we done everything possible to justify his hope for advancement for good performance?"

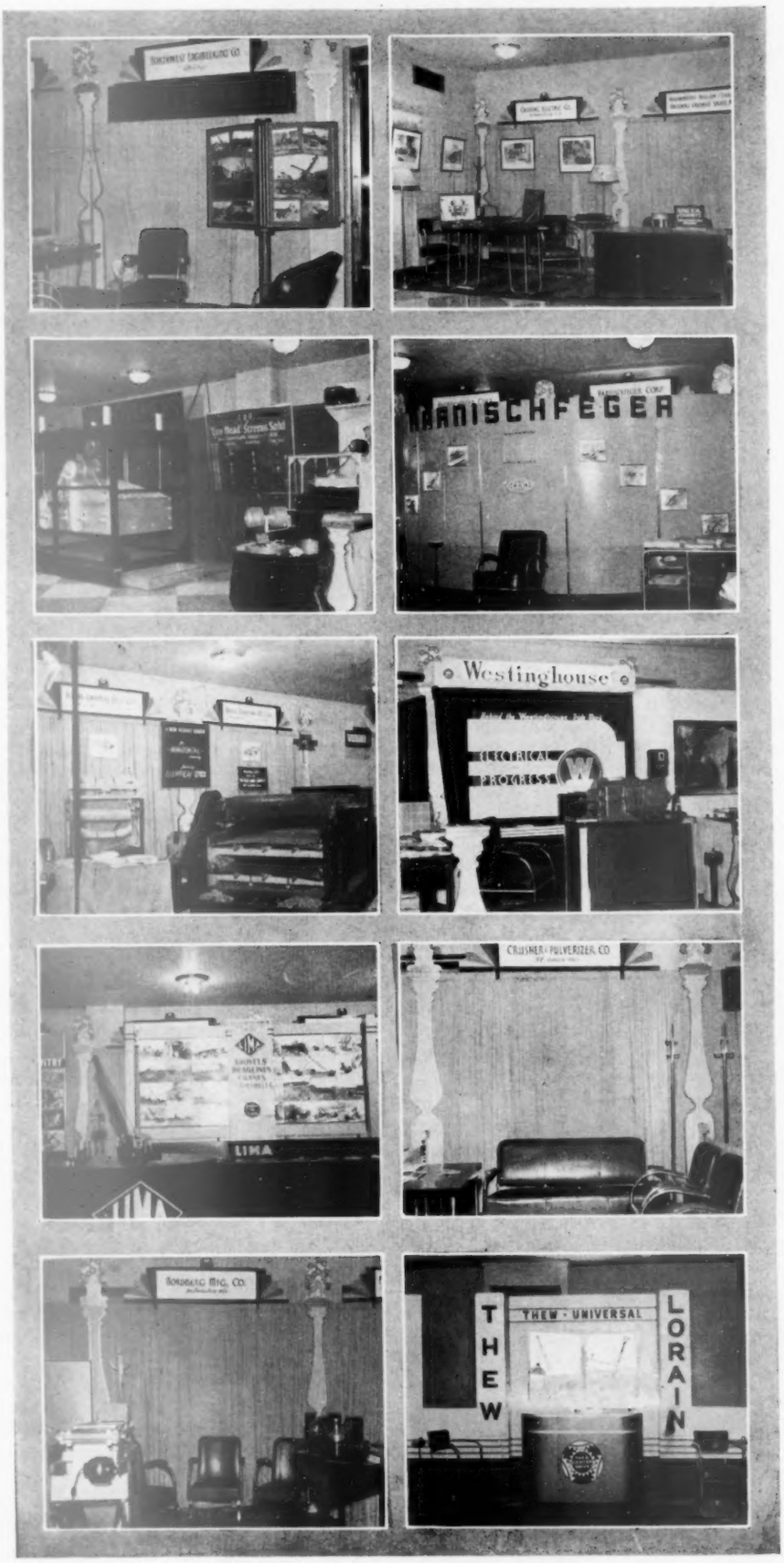
The worker wants the minimum of fear, the maximum of spiritual satisfaction, and the maximum of hope. He prefers to get these things from his employer at no cost rather than from his labor union at $1 or $2 a month. The workers are not radical in Mr. Williams' opinion and will not follow radical leaders in most cases, because, as one worker expressed it, "they promise too God damn much, too God damn quick."

Mr. Williams cited the Saar Valley as a place free from labor troubles despite the fact that the mine owners are French and the workers German. The French engineers who operate the properties study labor relations as a part of their technical training and spend several hours each day underground with the men in their charge. This develops their understanding of the worker's needs and problems.

The afternoon session closed with the presentation of a sound-slide film entitled "Men and Machines." Although described in the program as "a picturized answer . . . to the fallacy of technological unemployment," the picture showed only the growth in the number of persons employed in manufacture as the result of the invention of the motor vehicle and did not deal with the problem of unemployment caused by the introduction of labor-saving production machinery.

At the Tuesday morning session presided over by N. E. Kelb, general manager, Ohio & Indiana Stone Co., Indianapolis, M. J. Gormley, executive assistant to the president, Assn. of American Railroads, Washington, talked about *Railroad Progress*. In 1936, he said, freight-car loadings were higher than in any year since 1931 and passenger traffic was the heaviest since 1930. Railroad purchases were the largest since 1930. Forty thousand new cars were ordered in 1936. High-speed traffic requires better track and roadbed. Although speeds have been increased 50 per cent., fuel costs have been lowered 25 per cent. Operating costs must be reduced to the point that will prevent competition by other forms of transport.

The railroads invested in new equipment and facilities $11,455,000 in 1930, but only $1,999,000 in 1933 and $1,327,-



CINCINNATI CONVENTION EXHIBITS: LEFT (top to bottom)—Northwest Engineering Co., Allis-Chalmers Co., Robins Conv. Belt Co., Lima Locomotive Wks., Nordberg Mfg. Co. RIGHT (top to bottom)—General Electric Co., Harnischfeger Corp., Westinghouse Elec. & Mfg. Co., Gruendler Crusher & Pulv. Co., Thew Shovel Co.

000 in 1935. They spent for operating expenses and labor in 1930 $13,000,000, but only $4,000,000 in 1932 and $8,000,000 in 1935.

The 6-hr. day, if adopted on the railroads, would add $15 a car daily to the operating expenses for hauling agricultural products and $14 a car for crushed stone.

A certificate of public convenience and necessity should be required before permission is granted for the improvement of waterways, in his opinion. He asked for assistance in preventing the enactment of legislation increasing the cost of operation without adding to safety or efficiency.

The Use of Agricultural Limestone in the Federal Agricultural Conservation Program for 1937 was the subject of an address by J. F. Cox, senior agronomist, Division of Program Planning, Agricultural Adjustment Administration. The primary purpose of the program is to raise farm income by reducing output. In 1932 farm income amounted to 5¼ billion dollars, in 1936 it reached 9½ billions. The present program is concerned with the prevention of losses through erosion.

The period in which farmers took everything from the land and returned little to it caused serious depletion of the lime content of the soil. At the Ohio Experiment Station one liming of the soil every five years in addition to fertilizing has doubled crop yields. Limestone is needed on all soils to make the helpful elements in fertilizers available to plant life, the speaker said.

Dr. Jacob Lippman, according to Mr. Cox, has found that lime is being taken from our farm land to the plow depth of 6⅔ in. at a rate which, if unchecked, will exhaust it in 175 years. The same authority estimates that the calcium, magnesium and phosphorous will be exhausted in 200 years. The farmers of Ohio should increase their use of lime five times, according to the findings of the Ohio station. The productivity of Ohio farms will be reduced one-fourth in 50 years if the methods now in use are not checked.

Erosion has affected over 60 per cent. of the tilled and tillable land of the country in the last 300 years. Fifty million acres of land has been ruined by water and wind and a similar amount has been damaged—a total of one-sixth of American farm land.

Fifty years of farming without lime or fertilizers has resulted in the exhaustion of the land, and there has been no rotation of soil-conserving crops, such as clover or alfalfa, to check it. Lancaster County, Pa., has used lime for more than a century and it is still one of the most productive counties. Clover and alfalfa crops were rotated and manure was used plentifully.

Limestone producers were termed "vendors of vitality" and "purveyors of pulchritude" by the speaker, who referred to the reputedly beautiful women of Kentucky as the results of a "judicious blending of limestone water with the spirit of the corn."

Nearly 4,000,000 farmers coöperated in the A. A. A. movement and shared in government distributions, receiving $470,000,000 from the United States government, said Mr. Cox.

Dr. R. R. Sayers, medical officer in charge of industrial hygiene, U. S. Public Health Service, Washington, talked informatively about *Silicosis—What It Is and How to Prevent It.* He traced knowledge of the disease back to the days of Hippocrates, when it was recognized as an occupational disease, and carried the historical account briefly through Agricola, who in 1556 called attention to it as a disease common among miners in the Carpathian Mountains, down to Rovida who in 1871 named the disease silicosis after he had found silica particles in the lungs of mine workers.

Dr. Sayers described silicosis as a "chronic disease of the lungs due to breathing air containing free silica and . . . characterized by certain symptoms: shortness of breath, decreased lung expansion, unproductive cough. There is no fever. The most characteristic finding, however, is a generalized nodulation throughout both lung fields, and it is miliary in type in the early stages, by which is meant that the nodules are about the size of millet seeds."

Dr. Sayers said further:

"It is further stated that we are not justified in making a diagnosis of silicosis, especially in the early stages, without a good X-ray or without a post-mortem examination. In later stages we can diagnose fairly well from the other symptoms. In the early stages—and this is important and we ought all to remember it—there are but few symptoms. The man feels as well as he ever did and he looks as well as he ever did. He has but little, if any, decreased capacity for his usual occupation, whatever that may be. Of course, as the disease advances and you get a coalescence of some of these very small nodules there will be more decreased lung expansion and shortness of breath, and therefore decreased capacity for the work. Later on these nodules become conglomerate. . . . They may occupy a good part of the lung fields and the man is definitely short of breath and he can not do the work he has been carrying on. In every stage he has an increased susceptibility to respiratory disease, especially tuberculosis, and that is important. . . .

"You will hear that race has something to do with it, nationality has something to do with it, age has something to do with it. They are unimportant. As for sex, few women have it because but few women work at the occupations that produce silicosis. The greatest predisposing cause is the presence of respiratory disease, especially tuberculosis. A man with active pulmonary tuberculosis is very much more susceptible and his disease will progress more rapidly, if he is exposed to the breathing of free silica.

"Since other individuals with silicosis are more susceptible to tuberculosis, men with active pulmonary tuberculosis should not be permitted to work with them for the same reason, so that they will not get the disease. . . .

"We have been emphasizing the free silica. Is that modified if it is a silicate? Yes, it is modified. We don't know so much about silicates. You know that asbestos is a silicate, and usually a magnesium silicate, but there are a number of different types of asbestos though they are all silicates. It is known to be harmful. It produces an entirely different type of reaction in the lung from that produced by silica dust, the silica dust producing a linear fibrosis of the lungs. . . .

"Silica dust may be quartz; it may be opal, it may be chalcedony. I believe that flint is a type of chalcedony . . . but I also understand that chalcedony is a fibrous form of quartz and that it has a colloidal formation in which it holds small quartz crystals arranged more or less in linear type. That has been shown to be more active than is quartz itself, and the amorphous form of quartz, such as opal, is again more active than is chalcedony, both being more active than quartz.

"The size of the particles that we breathe in the air that have been known to cause silicosis are of the order of the size of bacteria. Bacteria range from ½ micron up to 8 microns in their diameter. . . . Most of the particles are from 1 to 5 microns. . . . A micron is 1/25,000 of an in. . . .

"There is some evidence to indicate that the presence of calcium dust, such as limestone dust or gypsum dust, calcium sulphate, modifies the effect of silica in some way so that it protects a man to some extent. That has not been proved.

"Iron dust, hematite, has not been shown to protect men from silicosis. It has been shown to modify the character of the disease somewhat, but the men are still more susceptible to tuberculosis than is the average group. Their symptoms are similar to those produced by the pure grade of quartz dust.

"As to the concentration to which a man may safely be exposed, we have information from studies carried out in various parts of the world. . . . In South Africa the rock contains, according to data I have, a very high percentage of free silica—90 per cent. It is stated that with 4,500,000 particles of dust men will not develop silicosis causing disability during a working lifetime. In Australia working with sandstone, where the percentage of free silica, quartz, is about 80, they have set 6,500,000 particles as being the safe concentration. In the granite quarries of Bari, where the percentage of free silica is from 31 to 38, they have stated that a man can safely work in concentrations of 10 to 20 million particles.

"In the anthracite mines, in the rock, workings where the percentage of free silica is about 35, 5 to 10 million particles seem to be the safe concentration. In the haulage ways, where the percentage of free silica is 13, the safe concentration is about 10 to 15 million, and at the working face, with a percentage of free silica of 5, the safe maximum concentration of dust particles is 5,000,000.

"Based on all the studies that we have, it would seem with a highly siliceous ore or rock 5,000,000 particles would be safe. You will not develop silicosis in a working lifetime if the concentration does not exceed that amount. That is probably as far as we have data on which to base a statement. However, for control purposes, as a useful control figure and subject to modification, a formula might be worked out where you would use a percentage and, knowing the concentration in the air, you could say whether the man was likely to be safe or not. It may be a little dangerous to give it because it is not based on actual studies, but you could take the percentage of free silica in the dust that you are breathing and multiply that figure expressed as a decimal by the number of particles in the air breathed. If the result is less than 5,000,000, the air probably will be satisfactory. For instance, if you had 10 per cent. of free silica in a dust and you had 30,000,000 particles in the air, multiply that 10 per cent. expressed as a decimal by the 30,000,000 and you will come out with a figure of 3,000,000. That would be a satisfactory working condition. But presume that you had 30 per cent. free silica and 50,000,000 particles in the air; you would come out with 15,000,000, which be unsatisfactory, because eventually your men would probably get a disease of the lungs that would cause disability."

Engineering knowledge and medical knowledge are essential for the prevention of silicosis, according to Dr. Sayers.

"It is obvious that if the dust was not formed, if we had a method of doing our work so that dust was not formed, there would be no hazard; and if the dust, after once being formed, was not permitted to get into the air to be

breathed, there would be no danger to the man. Therefore, wet methods were first thought of, wet drilling, wetting of all materials that are to be handled, because the dust does not get into the air if it is properly done. So wet methods where they are practical can quite frequently be used successfully in protecting the man. . . .

"Isolation of dusty processes is another method. If you have a process that is dusty, put it into an inclosure so that the dust can't get out into the air to be breathed by the men. Quite frequently that has been a successful method. At least isolate all dusty processes so as few persons will be exposed as possible, and in most of the operations with which I am acquainted you can do a great deal with isolation.

"The next is ventilation; first, local ventilation, exhaust ventilation around drills and over crushers, to draw the dust away, making an air seal around the dust-producing process, and you can do that. It has been practical to do that. Good ventilation is helpful because that removes dusty air and dilutes dusty air with clean air.

"Finally, personal protection, such as the use of positive-pressure air helmets, sometimes called masks, where you secure your air to be breathed from a clean source. . . . These are now approved by the United States Bureau of Mines. Several types are on the market that are useful. Most persons do not like to wear respirators while at work as they are a handicap. It is not the solution of the problem. It is a useful piece of apparatus for temporary use, for emergency use, intermittent use, and in special places. All respiratory equipment that I know of is a handicap to the workman. The conditions should be corrected so that it is safe for a person to work.

On the *Legal Aspects of the Silicosis Problem* Theodore C. Waters, of Stockbridge & Waters, Baltimore, presented some interesting views. If the concentration of silicosis dust particles does not exceed 5,000,000 10-micron or smaller particles per cu. ft. of the air to which workmen are exposed, there is no silicosis problem. The seriousness of the problem should not be minimized, but press reports exaggerate conditions.

Before the passage of workmen's compensation acts the worker could collect for injuries received in his employment only if the employer had been negligent. He assumed the risks of his employment and the results of the contributory negligence of himself and his fellow workers. These acts covered injuries only and provided exclusive remedies. They made the employers the insurers of their employees.

The social need for disease compensation has been recognized and, as a result, employers are now the legal insurers of their employees' health. This has been done on the theory that the costs of industrial diseases should be borne by the industries causing them and not by society generally through public charity.

Mr. Waters described a typical silicosis case as one in which the plaintiff (the worker) alleges that he has been required by the defendant (the employer) to work in a dangerous silicaladen atmosphere and that the defendant has been negligent in not warning him of the hazards of the employment and in not adopting preventive measures. The defendant sets up as his defense the negligence of the worker and his coworkers and the duty of the worker to assume the risks of his employment. The testimony brings out the failure of the defendant to provide preventive equipment. Sensational stories are carried by the newspapers, class is set against class, other suits are filed. It is almost impossible to obtain an impartial jury or an impartial trial. The entire community becomes prejudiced against the defendant before the trial is really started. Occupational-disease legislation would prevent this and special laws different from the workmen's compensation acts are needed, in the speaker's opinion.

Mr. Waters favors a law covering only demonstrated disability. Silicosis unaccompanied by infection is not disabling, but if laws for partial disability are passed, every victim would be entitled to some compensation.

Few doctors are trained in industrial hygiene and few are able to diagnose silicosis. The author advocates the appointment of a board of three members including two Roentgenologists in each state.

In Mr. Waters' opinion, workers and employers should be more interested in prevention than compensation. The first cost may be high, but it will be less than compensation. Society will not much longer countenance the failure of employers to adopt the mechanical means of prevention now available, however inefficient they may be.

Stirling Tomkins, vice-president, New York Trap Rock Corp., presided over the Wednesday morning session. In the absence of W. W. Adams of the U. S. Bureau of Mines Mr. Tomkins made the presentation of awards for the 1935 National Crushed Stone Assn. Safety Contest. These awards are contributed by the *Explosives Engineer*. The leaders in the 1935 contest were listed in PIT AND QUARRY (October, 1936, p. 32). In accepting the first-prize trophy for the Krause, Ill., plant, E. A. Heise, safety engineer of the Columbia Quarry Co., commented on the remarkable record this company has made in this competition. In the six years in which the company's three plants have been in this contest two of them have gone four out of the six years without a lost-time accident and the Krause, Ill., plant now has a clean record for four consecutive years beginning with 1933. The eighteen other quarries operating without a lost-time accident in 1935 received certificates of honorable mention.

In *Significant Developments in Highway Investigations* E. F. Kelley, chief, Division of Tests, U. S. Bureau of Public Roads, summarized briefly and in non-technical language the more recent developments and the present trends in those phases of highway research of particular interest to the crushed-stone industry. Growing knowledge of the many factors affecting the quality and strength of concrete shows that some of the characteristics of the aggregates used in the concrete are as important as the water-cement ratio. These facts, he said, have led the Bureau of Public Roads to favor the so-called trial method of designing concrete for pavements.

According to Mr. Kelley, the trial method of design makes it possible to produce concrete of uniform strength under varying conditions by means of controlled laboratory tests, although it does not insure durability or freedom from cracking in the concrete. He cautioned strongly against the indiscriminate and unrestricted use of the trial method as the laboratory tests required must be made with great care and in accordance with a standard procedure. In using this method some limitation should also be placed on the minimum cement factor and the maximum water-cement ratio to insure a durable concrete. Under no conditions, said Mr. Kelley, should the water content of concrete subjected to severe weathering exceed 6 gal. per sack of cement.

The durability of concrete is dependent to a large extent on the soundness or durability of the aggregates used and, according to Mr. Kelley, the problem of developing some method of test that will be a definite measure of the durability of aggregates is still unsolved. The sodium-sulphate test commonly used for this purpose is not wholly satisfactory because of the difficulty of controlling important variables in the test procedure. This method, he said, should be used only as a warning of possible unsoundness.

The Los Angeles rattler abrasion test is said to be a much more satisfactory method for measuring the resistance of coarse aggregates to wear and impact than either the Deval abrasion test or the standard toughness test. According to Mr. Kelley, this test gives much more accurate results than either of the other methods, requires less time and comparatively simple equipment. The de-

gree of angularity of the aggregate particles has very little influence on the results of the Los Angeles test so that approximately the same results are obtained with crushed stone and rounded gravel of comparable quality. Another advantage is that in the case of rock the test is made on the prepared crushed material and may be made either before or after delivery of the material. Also, according to the speaker, there appears to be a better agreement between the test results and the behavior of aggregates in service than is the case with either the Deval test or the toughness test. The widespread dissatisfaction with the older methods of testing is evident from the interest that has been shown in the Los Angeles test and the eagerness with which it is being studied by testing engineers.

The introduction of high-frequency vibration as an aid in placing concrete, he said, was one of the outstanding developments in construtcion during the past several years. The making of higher density and greater durability, using more coarse aggregate and less water, is possible with this method. These methods, he said, can be applied with equal success to pavements and mass concrete, but have not yet achieved the widespread popularity they deserve.

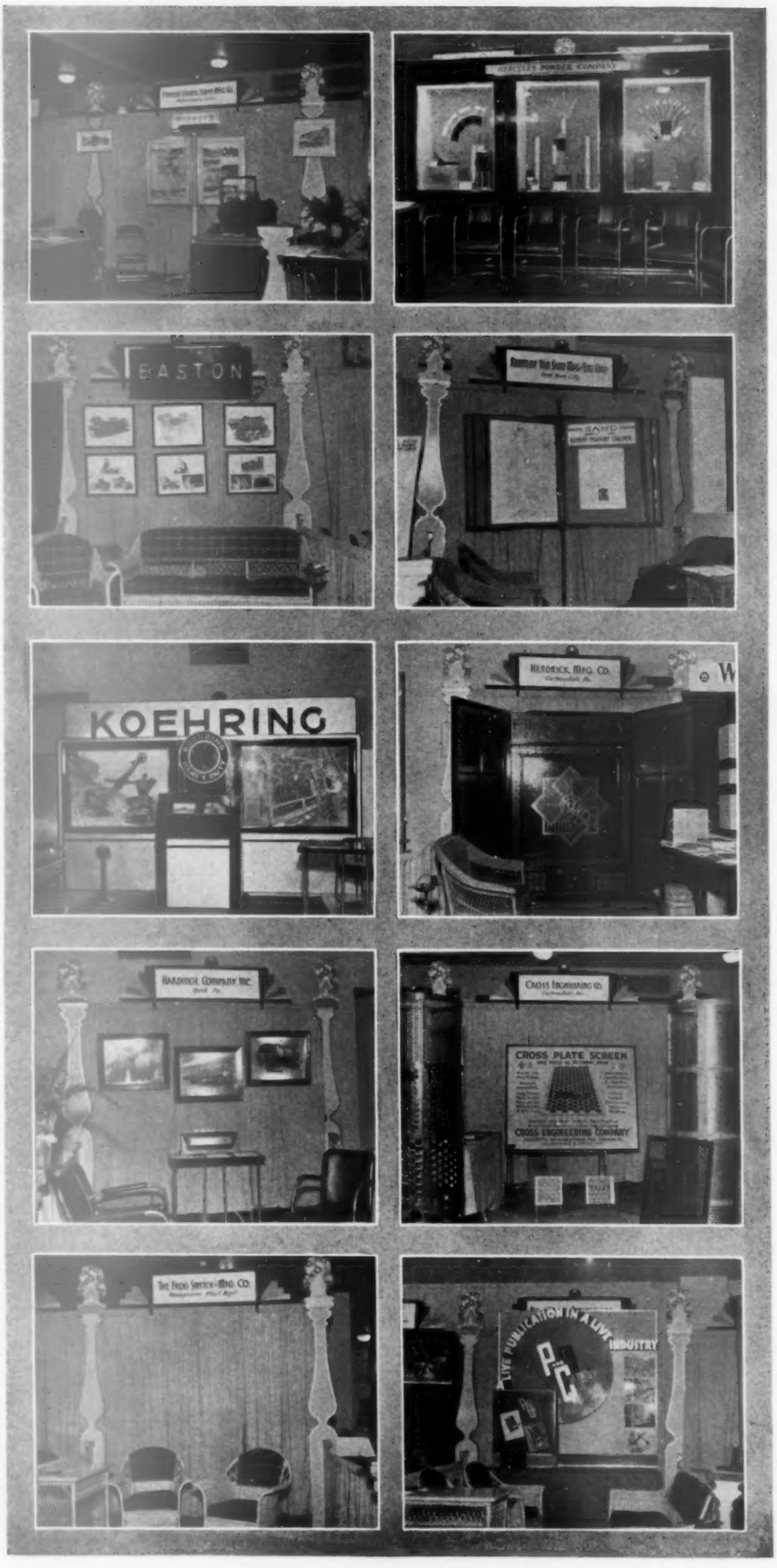
The inability of some aggregates to be coated or to retain a coat of asphaltic emulsion is also worthy of considerable study. This trouble, said Mr. Kelley, is due to the fact that the rock material has a greater preference for water than for asphalt. This problem, he said, is primarily one of surface chemistry and its interest to producers lies in the possibility of changing the surface characteristics of aggregates that otherwise would be unsuitable for use.

Mr. Kelley went on to say that there is no reason why stone sand of suitable grading made from sound rock should not be satisfactory for use in Portland-cement concrete.

The most important development of recent years in the field of highway research, said Mr. Kelley, is the progress made in the study of soil materials with respect to their use in highway construction. Stabilized roads promise to become one of the largest markets for aggregates which, he said, are definitely required in the graded type and are advantageous in those stabilized with bitumins or Portland cement. He also advised the establishment by producers of proportioning and mixing plants near the construction projects as a service which would be welcomed by engineers and contractors.

In the absence of C. L. McKesson, vice-president of the American Bitumuls Co., San Francisco, Cal., his paper, *Stabilizing Quarry Fines for Base Construction,* was read by Chas. D. Jones,

CINCINNATI CONVENTION EXHIBITS: LEFT (top to bottom)—Jeffrey Mfg. Co., Simplicity Engineering Co., W. S. Tyler Co., Link-Belt Co., Kensington Steel Co. RIGHT (top to bottom)—Traylor Engineering & Mfg. Co., E. I. duPont de Nemours & Co., Bucyrus-Erie Co., Marion Steam Shovel Co., Atlas Powder Co.



CINCINNATI CONVENTION EXHIBITS: LEFT (top to bottom)—Pioneer Gravel Equipment Mfg. Co., Easton Car & Const. Co., Koehring Co., Hardinge Co., Frog, Switch & Mfg. Co. RIGHT (top to bottom)—Hercules Powder Co., Kennedy Van Saun Mfg. & Eng. Corp., Hendrick Mfg. Co., Cross Engineering Co., Pit and Quarry.

Baltimore, Md., district manager of the company. According to Mr. McKesson, soil studies resulting in better subgrades have made possible the use of inexpensive non-rigid, low-cost subgrades where heavy slabs were formerly necessary. Quarry waste, consisting of dust, clay, weathered rock, etc., makes a high-class base material which, when treated with emulsified asphalt, he said, can be made into a durable, water-resistant, load-supporting base. This base he claimed to be actually more valuable than an untreated base constructed of carefully selected and high-grade crushed-stone products.

In this paper Mr. McKesson pointed out that a waterbound base mixture, in which clay or stone dust acts as the binding material for coarse aggregates, necessitates precise control as to the gradings and selection of the finer material, otherwise the base ravels when dry, or becomes muddy and unstable when wet. He states that, with the process advocated by his company, the binder being waterproofed, an excess of binding materials can be safely used and the base remains stable under all weather conditions. This process requires only that, in the preparation of the mixture, the binder content passing 200-mesh be kept above a certain minimum (usually 15 per cent.) and that a sufficient amount of the proper quality of emulsified asphalt be used to prevent the binding material from taking up sufficient water to lose its cementing value and become a lubricant.

"Stabilized base mixtures still depend upon cementitious rock dust or even pure clay as the binding medium for the rock and sand particles. Due to the fact that the binder is waterproofed in this process, an excess of cementitious material or clay can be used and the road develops even greater strength and supporting power than the well graded untreated base materials. Due to the water-resistant properties, the base remains stable under all weather conditions.

"In the preparation of such mixtures it is only necessary to maintain the binder content passing 200-mesh content *above* a certain minimum (usually 15%) and use a sufficient amount of the proper quality of emulsified asphalt to prevent the clay, or other binder, from taking up sufficient water to cause it to lose its cementing value and to become a lubricant. The theory behind this treatment is as follows:

"The aggregate mixture is wetted with water as in the ordinary waterbound base work, but in this water is contained the proper amount of asphalt in particles of microscopic and submicroscopic size. As this water is mixed with the aggregate, these particles of asphalt are dispersed throughout the mass so that they may mingle with the fine min-

eral particles. In this state the asphalt particles are tiny spheres having an average particle size of approximately 1/25,000 of an inch. As the water dries out of the mass, the water films on the fine particles become, eventually, so thin as to develop tremendous surface tension, not only in the films surrounding the fine mineral particles, but also in the films surrounding the asphalt globules. As this drying continues, this surface tension pulls the asphalt from its spherical form into films of extreme thinness, thus forming a coating of asphalt around each particle of binder. This coating is now held under a force of absorption so great that even the asphalt is changed in its characteristics. Asphalt which was normally completely soluble in such solvents as carbon tetrachloride is now so changed that it is no longer soluble, and a large portion can not be removed from the mixture even with boiling carbon tetrachloride.

"The surfaces of these cementitious rock of clay particles are thus coated with a water-repellent substance and it can readily be seen why they no longer have the affinity for water which formerly caused the loss of binding value in the presence of water."

When this treatment is properly carried through, said Mr. McKesson, the binder becomes permanent and a base constructed of these materials maintains its supporting value in spite of seasonal moisture changes. In this treatment about 1 cu. in. of asphalt is made to coat as much as 18,000 sq. ft. of aggregate surface and the coating is so thin that it does not interfere with the natural cementing power of the binding material. In most cases 1.65 per cent. of asphalt in quarry waste is sufficient. Only simple mixing and batching equipment is required and once the correct mix has been established few tests are needed. In answer to a question Mr. Jones stated that no drying of the quarry waste is necessary and moisture is not a handicap so long as the content is known, as water is added before the ingredients are run through the mixer. The limit of time between mixing and placing should be short unless the mixture is stored in stock-piles where dehydration would be negligible.

R. A. Giddings, secretary, Calcium Chloride Assn., Detroit, Mich., in *Low Cost Roads Will Multiply Stone Market* pointed out that two out of every three miles of our highways are quite unimproved and that for every mile of pavement there are 25 miles of side roads. This condition, he said, has prompted the government to allocate a large share of highway funds to the improvement of "farm-to-market" roads with low-cost all-weather surfaces. Stabilized soil-aggregate roads were developed to meet this demand.

Mr. Giddings said that in his opinion the crushed-stone industry should be vitally interested in establishing its position so as to command an appreciable share of this market. The suitability of sized crushed stone for this type of road was stressed, as the best results depend on proper gradation. According to Mr. Giddings, this method, involving the use of clay as binder soil and calcium chloride as a deliquescent chemical, is the original, fundamental type of construction classed as "stabilization" and is its most widely used and accepted form.

"While the stability of a cohesionless sand may be less than 300 lb. per sq. ft. and that of a fairly stiff clay about 5,000 lb. per sq. ft., these two materials properly combined may have a supporting value of more than 17,000 lb. per sq. ft.," said Mr. Giddings. "As a matter of fact, only the cohesion of an almost liquid clay, about 130 lb. per sq. ft., is required to increase the supporting value of cohesionless sand from 270 lb. per sq. ft. to 2,500 lb. per sq. ft."

In the opinion of Mr. Giddings, in a few years all the aggregate used for road surfacing will be "stabilized." This material will not be used only on secondary roads, but will be used as a base course for all kinds of higher type surfacing, including blacktop, brick and concrete, for shoulders and widening streets, etc.

Mr. Giddings believes that the producer has an important advantage in getting this business because his plant is equipped to produce uniform graded aggregates. Combining these in correct proportions with a suitable binder soil and a moisture-controlling admixture and mixing them thoroughly is comparatively simple in an established plant. For the highway department the production of this material is much more of a problem, said Mr. Giddings, but unless the commercial producer takes advantage of this opportunity, these departments will establish producing facilities making it practically impossible for the producer to compete.

The advantages accruing to the producer through the production of this material include the possible utilization of soil strippings and waste sizes of aggregates. In this way the highway official and contractor, according to Mr. Giddings, get a more uniform mixture than is obtainable by blade mixing on the road, and avoid the dust nuisance during construction and the delays due to wet weather. The season during which these roads can be built is materially extended and many other advantages were cited. Mr. Giddings closed by stating that stabilized roads open a potential market that multiplies the present aggregates market by ten. Over 2,000 mi. of calcium-chloride stabilized streets and county and state highways now in use have demonstrated the practicability of the type.

Otho M. Graves, president, General Crushed Stone Co., Easton, Pa., presided at the closing session of the convention, when *Future Policies in State and Federal Road Building* and the *Outlook for Federal Legislation Affecting Industry* were the subjects scheduled for discussion.

W. C. Markham, executive secretary, American Assn. of State Highway officials, Washington, talked about road-building policies. In the course of his remarks he pointed to the fact that 16 per cent. of all motor-vehicle taxes were diverted to non-highway uses last year. The gasoline tax is opposed by the oil companies, who say that average gasoline prices dropped from 21.06c. a gal. in 1933 to 14.06c. a gal. in 1936, while average gasoline taxes rose for 1.8c. a gal. to 4.18c. a gal. in the same time. The prices have fallen naturally as the result of the development of new refining processes which doubled the amount of gasoline recovered from a given quantity of crude oil.

Roads must be designed to meet the service needs of the people. Many roads are satisfactory so far as the present volume of traffic is concerned, but are not suitable for very high speeds. Divided highways and elevated highways are needed. The divided highway is safer and can be built if needed and if the people near it are willing to pay the cost.

On the subject of coming federal legislation, John C. Gall, associate counsel, National Assn. of Manufacturers, Washington, spoke at length. Talking about the effect of legislation on industries he said:

"Necessarily the Social Security Act bears with especial harshness on industries in which the labor cost is high in proportion to the total cost. The consequence is that that act does not affect all industries in the same way. It affects much more harshly those industries which have a very high labor cost, and that . . . is a very significant phase of the whole act, because it was introduced at a time of very high unemployment, at a time when reëmployment was the watchword of the day, and yet it is based on a tax on pay-rolls which, more than any other form of tax which could be devised, is a brake on the reëmployment of men and an encouragement to the substitution of machinery and labor-saving devices for the employment of men. . . .

"The Robinson-Patman Act is a measure designed, it is said, to strengthen the Clayton Act in its prohibition against price discriminations, and yet you will find that the impact of that act is quite different on different industries and different branches of the same

industry. It depends on whether a man considers himself primarily in the rôle of a seller or of a buyer as to what his attitude is toward that act. In industries which have a very high raw-material cost you will find that manufacturers are more concerned with themselves as buyers under that act; in industries which have a very low cost for labor you will find that they are concerned almost entirely with the application of that act to them as sellers and not as buyers."

He contrasted the situation of other social groups, such as labor, with that of industry and asked:

"Why doesn't business get together? Labor gets together and has a program; other groups get together and have programs. . . . The interests of different branches of industry are not the same with respect to any given proposal and consequently it is impossible for them to get together in the same way that labor and other groups can. It would be very easy for all the men in this room to get together, if all they had to get together on was one fact and that was that they all wanted something that they thought some other group had, and that is approximately the situation of labor organizations and groups other than the producing and manufacturing interests of the country."

Referring to labor bills, such as those for the 30-hr. week, collective bargaining and the Guffey Coal Act, he said, in part:

"The 30-hour bill I think has no chance of passage, nor has any other bill which fixes by congressional enactment a rigid maximum number of working hours in industry. The administration doesn't want it, industry doesn't want it, every economist of note in the country has condemned it as leading only to higher costs and not to greater employment, and many of the labor organizations themselves do not really want it at heart. It has been used ever since before the National Industrial Recovery Act was passed as a method of getting other legislation by using the 30-hr. bill as a club, and for that purpose it undoubtedly will be used at this session of Congress, but I do not anticipate anything like the 30-hr. bill will be seriously pressed to passage in this session."

The speaker then commented on proposals to amend the anti-trust laws, saying:

"I distinguish in my own mind between proposals to change the basic law, that is the substantive law itself, and proposals to change the method of administration. I think for business men to get behind proposals to change the substantive law is very dangerous. I believe that business men as a whole are in sympathy with the basic purposes of the anti-trust laws. . . . I think that in anything business men say, or in lending their support to moves to amend the anti-trust acts, they should make it very clear that what they are talking about is a change in method of administering the basic laws which exist. . . .

"I believe there is a great deal that can be done under the anti-trust laws in the way of voluntary coöperative effort without violating the acts as they at present stand, and that under proper legal advice groups can do a great many things that they haven't yet tried. For instance, it has been said by many people, and particularly by some of the people in the administration, that amendment of the substantive laws themselves is necessary before business men can agree in an industry as to minimum wages and maximum hours. I deny that. There is no case in the Supreme Court of the United States which throws any doubt whatever on the ability of business men under the present anti-trust acts to enter into reasonable agreements with respect to wages and hours. On the contrary, there are decisions, and in particular such decisions as that affecting the window-glass manufacturers and their employees—who are union members, by the way—under which the court has said that an industry may go very far in entering into voluntary agreements with respect to minimum wages and maximum hours in the industry without in any way violating the anti-trust laws; and in the Appalachian Coals case where a large number of coal operators got together on a common selling agency, the court used language which makes it clear that business has not even explored the possibilities of voluntary action under the anti-trust laws."

The Walsh-Healey Act has raised many questions, some of which Mr. Gall answered. This act requires, said the speaker, "that in all contracts in excess of $10,000 which are not exempted under the act the purchasing agencies of the government shall require certain conditions with respect to your operations. . . . The ones that primarily concern you relate to wages and hours. So far as wages are concerned, the Secretary of Labor has given authority in respect of all those contracts to prescribe minimum wages. The act went into effect Sept. 28 and no minimum wages have yet been prescribed by the Secretary of Labor, but the authority is there. In respect of hours, a maximum number of 40 hr. per week or 8 hr. per day is prescribed. After that you may work even without a specific permit from the Secretary of Labor any number of hours you choose, provided you pay time and one-half for overtime.

"There was a provision in the act that contracts for goods which could ordinarily be bought in the open market were exempt from the act. That exemption or that exception has been practically nullified by the Secretary of Labor by regulation, because the Secretary has provided that the only contracts over $10,000 which are exempt are those where the contracting agents of the government are not required to advertise for bids. Well, since the contracting officers of the government are required to advertise for bids in practically all cases over $10,000, the regulation means nothing except that the exemption that Congress intended in the act has been nullified by the Secretary of Labor.

"Another provision of the regulations which is very important and with which some of you may have had contact is that where an employee touches a government job for 1 hr. in the week, that fixes his status for the entire week, and that the limit on his hours, whether he is engaged in private work for the rest of the week or engaged in public work, is 40 hr. for the week and 8 hr. per day, after that overtime being paid. In other words, doing any work on a government contract job contaminates the employee in a legal sense and the employer is required to observe the maximum hour and overtime requirements of the act and regulations with respect to that employee for that week. . . ."

The Committee on Resolutions presented a lengthy document disclosing the attitude of the association on the general question of the relations between government and industry. It dealt with revival of the N. R. A., the anti-trust laws, the Robinson-Patman Act, the Wheeler anti-basing print bill, and other forms of legislation. This resolution was unanimously adopted after the reading of excerpts. The convention also adopted a resolution advocating the passage of laws prohibiting the diversion of gasoline and other motor-vehicle tax funds to other than highway uses. The resolution suggests "that Congress be urged to provide that Federal-aid highway appropriations be withheld from such states as, after a reasonable subsequent date, continue the unjustifiable practice of the diversion of motor-vehicle funds from their proper and intended purpose."

The convention reëlected the old officers and the old board of directors with two new producer members, Don Sanborn, Lehigh Stone Co., Kankakee, Ill., and W. C. Sparks, Cedar Bluff Quarry, Princeton, Ky. Max S. Lambert, Robins Conveying Belt Co., Chicago, was elected to the board to represent the Manufacturers' Division, of which he is chairman.

Left: Central concrete-mixing plant of Strathmann Sand & Gravel Corp. with one of trucks in foreground. Below: Locomotive crane transferring aggregate from barge to storage bins.

One-Man Control a Feature of This Ready-Mixed Plant

THE ready-mixed-concrete industry during the past two years has resumed the steady growth which had been abruptly halted by the preceding years of depressed business conditions. This growth includes the establishing of plants in small communities where no such facilities had previously existed and the establishment of additional facilities in the larger cities where overproduction is rapidly becoming a thing of the past. In the latter class is the plant of the Strathmann Sand & Gravel Corp., Philadelphia, Pa., which went into operation July 18, 1935.

This plant is located at the company's yard at 51st St. and the Schuylkill River which has been operated by the company since March, 1929, when its sand-and-gravel plant at Paulsboro, N. J., was erected. The aggregate plant was described in the August 27, 1930, issue of PIT AND QUARRY. At the yard the company has storage bins for 1,000 tons of sand and gravel for direct sales. This material is received in barges from the Paulsboro plant and is unloaded by a McMyler-Interstate steam locomotive crane with a 1½-cu. yd. clam-shell bucket into the sand-and-gravel bins. No gravel concrete is produced, but sand for the concrete is unloaded from barges by the same crane into a 15-ton hopper. This feeds a 20-in. belt-conveyor 245 ft. long which discharges into the concrete-plant bins. Trap rock used in the concrete is received in trucks or cars and is rehandled by the crane to the concrete-plant hopper.

A swivel chute allows discharge of sand and rock into the four compartments of the 200-ton Blaw-Knox bin which has steam jets for winter operation. Standard Portland cement is received in bulk in special cars which discharge into a longitudinal screw-conveyor alongside the track. A cross screw-conveyor feeds the cement to a 70-ft. bucket-elevator which discharges it into a 567-bbl. Butler cement bin. A Blaw-Knox rotary valve feeds the cement from this bin to a screw conveyor which in turn discharges the cement into a 1,500-lb. weighing-batcher fitted with a Fairbanks beam scale and a tell-tale dial. Sand and rock are fed by clam-shell gates into a Blaw-Knox 10,000-lb. weighing-batcher fitted with a Howe beam scale and a Weightograph. Water is measured in a Ransome siphon-type tank and all the ingredients are discharged into a Ransome 2-cu. yd. drum-type mixer.

All the controls for this plant are located on the batcher floor and are operated by one man. There are four push buttons which operate the cement screw-conveyors, the mixer and the elevator. Conveniently-located levers control the batcher feed and discharge gates.

Concrete is discharged from the mixer into agitator trucks. When special or high-early-strength cement is specified, this is dumped from sacks into the cement batcher.

The plant has produced as much as

The fleet of ten agitator-mixers operated by the Strathmann Sand & Gravel Corp. All the trucks have dual rear axles.

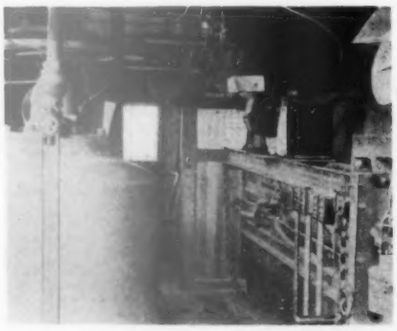
243 cu. yd. of concrete in one day. All the testing is done by the Conwell Eng. Co. which certifies the company's product.

The company began operations with four Blaw-Knox agitator trucks of 1½-cu. yd. capacity mounted on Ford chassis. Three of these have Timken dual rear axles and one has a Twinflex axle of that type. In March, 1936, six more units were added. These are 2-cu. yd.

Rotary valve and screw conveyor which feed cement from bin to batcher.

Blaw-Knox agitators mounted on Ford chassis with Truxmore dual rear axles. All have Hercules independent gasoline power units for rotating the drums.

Deliveries are made as far as 10 to 12 mi. in all directions from the plant. Most of the concrete produced goes into roads, buildings and sidewalks. According to Walter Ehly, plant superintendent, these trucks are averaging 6 to 7 mi. per gal. of gasoline hauling 2½-



Batching floor with water-measuring tank at left and aggregate batcher and scale at right.

and 3-cu. yd. loads and gross weights as high as 26,000 lb. The company also has five dump trucks at this yard for delivering aggregates.

This central-mixing plant is a combination of new and used equipment. The cement bin and batcher and the aggregate bin, batcher and mixer were brought from separate construction projects. All the other equipment is new. The belt-conveyor to the plant was furnished by Sprout Waldron & Co. and the belting by the U. S. Rubber Co. The three cement screw-conveyors were supplied by the Link-Belt Co.

Magnetic Separators in Production of Bauxite

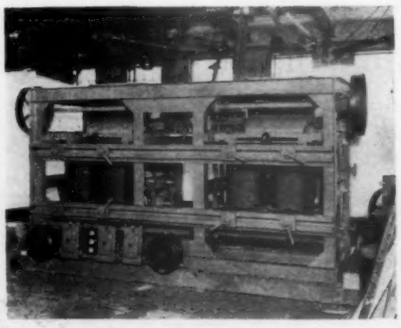
The principal bauxite deposits in this country, and practically the only locality where bauxite mines are operating, are in the vicinity of Little Rock, Ark. Most of the deposits are owned and operated by one large company, but there are a number of others with relatively small deposits.

In general, there are two main uses for bauxite. One is for the manufacture of aluminum and for abrasives. The second use is for the manufacture of alum. The ore used for the manufacture of abrasives and aluminum is classified as calcined ore, and that used for the manufacture of alum, used in the paper industry, is classified as chemical ore.

The requirements for calcined ore are: (1) low silica content; (2) the ore should be "hard" and should break with sharp edges rather than in balls or spheres. The iron content after calcining should not exceed 7 per cent. Fe_2O_3.

Calcining removes the moisture, also the hydrated water; but in calcining the iron content in the original ore is increased by approximately 70 per cent. However, this iron can be removed by a magnetic pulley as the calcining increases the magnetic susceptability of the iron, making it readily removable by a medium-intensity magnetic separator.

Contrasted to the calcined ore, the chemical ore requirements are that the iron content be below 2 per cent. Fe_2O_3, and the alumina content from 57 per cent. to 60 per cent. Deposits of bauxite ore with a low iron content, that is around 2 per cent. Fe_2O_3, are practically all held by one large company. Other deposits which heretofore have been worked are exhausted of their low-iron-content ore. This year the owners of the largest of the smaller deposits found that their supply of low-iron-content bauxite ore was exhausted and had about decided to close their plant and buy the necessary low-iron-content ore elsewhere. They had previously tried many methods for removing the iron from the ore, but the results were unsuccessful.



Magnetic separator of the type used in extraction of iron from bauxite ore.

After considerable experimentation in the Dings laboratories a successful and practical method for removing this iron by magnetic attraction was found. It was found possible to take bauxite ore containing 6 per cent. Fe_2O_3 and higher and, after passing it over the Dings Super High-Intensity Type IR machine, to reduce the iron content to less than 2 per cent. Because of this solution, and as the cost per ton of so treating the ore was so low, a battery of Type IR machines was installed. The company is now producing chemical ore having an iron content of considerably less than 2 per cent. and the cost of this magnetic treatment is negligible.

Special-Cements Report Covers Mass Concrete

An exhaustive technical report on *Special Cements for Mass Concrete,* by J. L. Savage, chief designing engineer of the U. S. Bureau of Reclamation, has just been issued by the Bureau. This report is a summary of all the available information and experience in this country on the subject, putting in concise form knowledge gained from the construction of Boulder Dam and the experiments which preceded its construction and that of Grand Coulee Dam. These investigations have reduced to a minimum the shrinkage stresses and virtually have eliminated cracking of large concrete masses. They have also minimized the effect on concrete of the disintegrating elements.

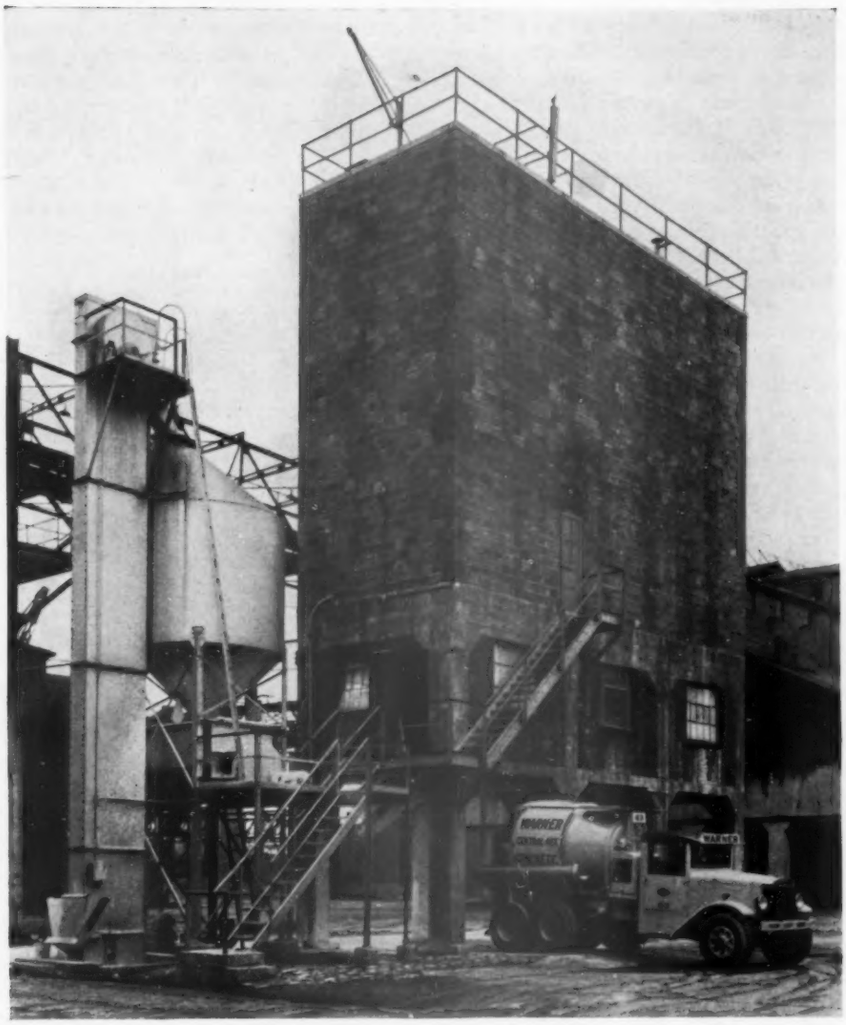
The report, which contains 230 pages and 78 figures and formulæ, was printed by the U. S. Bureau of Reclamation, Department of Interior, Washington, D. C.

Molasses, Sand and Lime Used on Indian Roads

A fifty-mile stretch of road in India is constructed essentially of molasses, sand, and lime. Mixed with water, the waste molasses from a sugar factory is spread over the surface of the road, and, after a half-hour's soaking, is covered with coarse sand when it is ready for traffic.

To prevent the molasses from being washed away by rain, burned lime is being added to form tri-calcium sucrate, which is insoluble in water.

By W. E. TRAUFFER



The lime-putty plant at the Berks St., Philadelphia yard of the Warner Co.

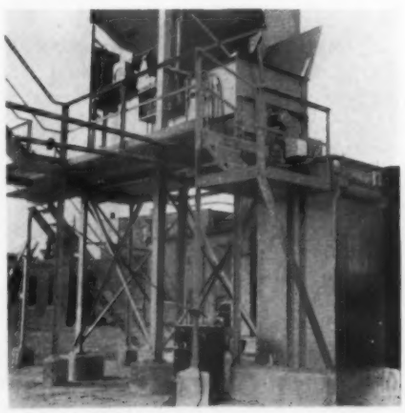
Warner Co. Making Deliveries from Second Lime-Putty Plant

THE death of another of the old traditions which have checked the progress of the lime industry and the expansion of its markets seems imminent from the growing acceptance of aged lime putty manufactured by the Brooks-Taylor process. From time immemorial lime putty has been hydrated and aged and then mixed with sand in crude mortar boxes on the job to form mortar. In spite of the many obvious disadvantages of this method most of the mortar used in building construction to-day is made in this same inefficient, tedious way which can not produce any large quantity of mortar of consistently high quality and which necessitates starting the process days before the mortar is to be used. It is this ancient method which has been to a large extent responsible for the gain by the cement industry of a large share of the market on which the lime industry formerly had a monopoly.

The aging of lime putty in large vats and the sale of it to contractors as putty or (mixed with sand) as mortar was only a partial solution of the problem and production by this method has never been an important factor except in some of the larger cities. The Brooks-Taylor process, which guarantees a constant supply of fully-aged quicklime putty of consistently high quality, has none of the disadvantages of former methods and offers the contractor immediate delivery of a superior product at reasonable cost.

The first installation of this process, outside the original experimental plant, was made by the Warner Co. at its Wilmington, Dela., yard late in 1935. The Super Concrete Corp., Washington, D. C., put a similar plant in operation in March, 1936 and enlarged it in July (P&Q, Sept., 1936, pp. 54-56). Because of the success of its Wilmington plant the Warner Co. built another plant at its Berks St. yard in Philadelphia, Pa. and put it in operation in July, 1936. This plant incorporates a few minor changes in process and, unlike the two plants mentioned above, its seasoning tanks are placed on concrete foundations and the batching floor and tanks are completely inclosed with brick and tile, respectively. In the previous plants two tanks, each having four filters, were first installed and a third tank with an improved central filter was added later. The Philadelphia plant has three tanks with central filters.

The crushed and screened dolomitic quicklime used in this plant comes from



The mixing and slaking equipment with open-top mixer above.

View under lorry floor showing truck being loaded.

the Cedar Hollow, Pa. lime plant of the Warner Co. The quicklime is discharged from cars or trucks into a hopper feeding a steel-inclosed bucket-elevator from which it is discharged into a 20-ton circular steel storage tank. This tank has a conical bottom with a single opening and an arc gate. Quicklime

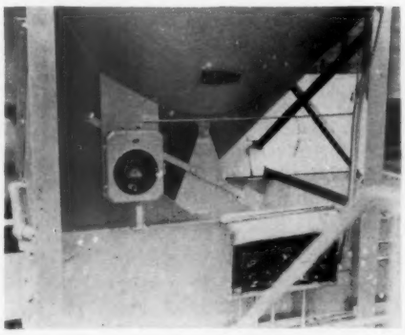
The rail-mounted batcher under one of the three tank gates.

is discharged from this tank directly into the open-top spiral-blade mixer or slaking machine which keeps the lime in agitation during hydration. About 2,200 lb. of dolomitic lime is slaked in one batch. A recording thermometer allows accurate control of the slaking process.

After the lime has been slaked and reduced to the consistency of cream it is discharged on a single-deck vibrating screen which removes any unslaked particles or foreign matter. The screened milk of lime is then pumped into any of the three storage tanks for aging. These tanks are 10½ ft. in diameter and 28 ft. high and hold 90 cu.yd. of putty each. During the process of filling a tank excess water is allowed to filter off and this continues after the tank is filled until the putty has reached the desired consistency. Then the valve on the lower end of the filter column is closed and the putty allowed to age. The cycle of filling, aging and emptying each tank takes about 9 days, giving the plant a maximum capacity of 10 tanks, or about 900 cu.yd., of putty per month. The capacity of the plant is limited by the number of tanks and can be increased by adding more tanks as the remainder of the plant can handle several times the present output.

As explained in the previous article the use of a single central vertical filter in these tanks has accelerated the removal of excess water. The filter pipe has an inside diameter of 3 in. and has groups of three ½-in. by 6-in. slots spaced 120 deg. apart at 23-in. intervals. These slots are covered with 16-mesh screen cloth 8 in. wide wrapped around the pipe. At the top and near the bottom of this pipe, 31 ft. 4½ in. apart, 16-in. diameter circular plates are attached to the pipe and these are connected near their edges by six ¾-in. vertical rods spaced 60 deg. apart. This vertical cage is inclosed by 16-mesh wire cloth 36 in. wide wrapped spirally around it and welded into place. The space between this outer hexagonal screen and the pipe is filled with coarse sand. This method insures against the loss of lime putty in the filtering process. Actually the water drained out through the pipe is almost pure enough to drink. This cage filter is so supported that it can be rotated for inspection from a ladder on the inside of the tank. Near the discharge opening in the conical bottom of the tank is a horizontal shaft with paddles attached. This shaft extends through the tank shell and can be rotated by a handle to agitate the putty and insure complete discharge of the contents of the tank.

When the putty is properly aged and ready for use, it is discharged through



Recording thermometer which controls slaking process.

a special water-tight gate valve into a measuring lorry or movable batcher, which is mounted on rails and can readily be moved to the proper position under whichever tank is being emptied. The batcher discharges the lime putty direct into trucks for delivery. A larger opening with a lever-operated sliding gate, at the bottom of each tank is used for final cleaning out. There is also a manhole at the top of each tank. As was previously stated, the batching floor is completely inclosed.

Another view of the Philadelphia plant taken before the tanks were inclosed. The truck is being loaded with lime putty.

CONCRETE INDUSTRY MEETS IN CHICAGO

"GENTLEMEN, we are making history!"

With these words William G. Kaiser, manager of the Cement Products Bureau of the Portland Cement Assn. opened the joint session of the National Concrete Masonry Assn. and the National Conference of Concrete Contractors during their conventions, Jan. 18-20, in Chicago.

"This is the largest aggregation of concrete men ever assembled in one body in my recollection, and I've been connected with the industry for over 20 years," said Mr. Kaiser.

From half of the United States and from Canada and England 1,500 concrete contractors, builders, and cement-products men packed the convention and exposition halls. Every last shred of new construction and merchandise information that was divulged in formal meetings, in round-table conferences, in group discussions, and man-to-man "confabs" was snapped up by a horde of builders who, feeling the upsurge in construction business, were hungry for new ammunition with which to make even more successful attacks on the construction market. Tales of increasing business coming in from every quarter added impetus to the quest for the latest data.

From a mere added attraction, the Concrete Industries' Exposition of concrete machinery leaped up to be a thriving buyers' market with every exhibitor closing orders throughout the show. Forty exhibitors made up what was the biggest display of concrete mixers, products machines, concrete pumps, and miscellaneous devices since the old cement shows of a quarter of a century ago. Concrete contractors and products men came ready to buy long-needed equipment and did to the extent of many thousands of dollars. At a luncheon of the exhibitors on the closing day (Jan. 20) Gene Olsen, chairman of the exhibitors' advisory board, said, "It was the best 'buying' show that I have ever experienced in my 27 years with the concrete industry."

A feature of the week was the merger of the National Cinder Concrete Products Assn. and the National Concrete Masonry Assn. with the name of the latter being adopted. Daniel F. Servey of the Haydite Corp., Kansas City, Mo., was elected president of the new body, his second term as head of the masonry association. Three vice-presidents were named: George H. Krier of the Nailable Cinder Block Corp., Brooklyn, N. Y.; Roy McCandless of Cinder Units, Inc., Detroit; and Louis B. Weatherbee of the John N. Black Co., Buffalo, N. Y. Walter A. Sherman, executive secretary of the Milwaukee Concrete Products Assn. was elected secretary-treasurer. D. R. Collins of the Portland Cement Assn. was appointed assistant secretary. Elected to the board of directors were: Benjamin Wilk of Standard Building Products, Detroit; John S. Chase of Chase Building Products Inc., Fort Worth; Harry F. Longenecker of the National Building Units Co., Philadelphia; Oscar Schmidt of the Cinder Products Co., St. Joseph, Mo.; and H. A. Kilmer of the Iowa Crib & Silo Co., Des Moines.

During the three-day gathering, the Cast Stone Institute held its annual meeting at the Bismarck Hotel, while at the Edgewater Beach Hotel, representatives of the American Concrete Pipe Assn. met in their annual business session.

As a parallel climax concrete contractors from all parts of the nation convening in this first conference decided by popular vote that an association of concrete contractors be formed. As a result, an organizing committee was appointed to work out plans for creating the new association. Bert Carey of Bert Carey & Co., Forest Park, Ill. was named national chairman of the committee. Assisting him are: Ralph C. Condo of James Condo & Son, Somerville, N. J.; Carl V. Carlson of Victor Carlson & Sons, Inc., Minneapolis, Minn.; Charles J. Haase, Paris, Ill.; and Frank Klepach of the Hartman-Klepach Co., Cedar Rapids, Ia.

Twenty papers presented at the two series of meetings during the three days covered the fields of concrete manufacture and placement from every angle. Each talk was as important to the industry as the next, which was evidenced by the keen discussions that followed.

For the home-building industry represented at the joint session Bernard L. Johnson, editor of *American Builder* sketched a picture of the future. Said he: "A half million homes will be built in 1937—the residence building industry is on the verge of the greatest boom in American history—there is a definite shortage of 2,500,000 family units to be filled within the next ten years."

"In the early 1920's, conditions were very similar to to-day's," Mr. Johnson said. "At that time residential construction jumped from a 'low' of 250,000 units in 1920 to approximately 700,000 in 1922. This amazing increase was the result of a period of non-building during the war. The need for homes to-day is even greater

Interesting Facts About the Concrete-Masonry Industry

More than 3,000 established plants produce concrete-masonry units in the United States and Canada.

Over $100,000,000 is invested in plants manufacturing concrete-masonry units.

More than 7,000,000 cu. yd. of aggregates are used in a normal year by the concrete-masonry industry.

Over 150,000 men are employed by the concrete-masonry industry.

More than 30 per cent. of all masonry construction employs concrete-masonry units.

than in 1920. The absolute dearth of building in the depression years not only cancelled any overbuilding, but has built up a deficiency that must immediately be remedied."

Theodore E. Damm, chief of the F.H.A. industries section, spoke on the subject of housing, saying that all indications point toward the greatest program of small home building in the history of the nation.

"Builders, in concentrating on high-priced houses," Mr. Damm said, "have entirely neglected the low-cost field in which approximately 70 per cent. of the market lies. Research shows that never before has there been so much money in savings accounts, or so much capital available on long-term, low-rate loans—indication that only good salesmanship and a little push are needed to start house building on a really large scale." He asserted that the F.H.A. is ready and waiting to coöperate in every way with industry in starting the ball rolling.

In technical discussions houses also took the spotlight with details of modern concrete wall and floor construction coming up for attention. At the contractor's meeting Robert Schwartz of the Gambsky Co., Menasha, Wis., revealed cost and construction data gathered from the actual job of building the monolithic-concrete Purdue Research Foundation house at Lafayette, Ind.

"Our experience has shown that reinforced-concrete houses can come within a moderate price range and can be profitably built by the average contractor equipped with adequate equipment. The public is rapidly becoming concrete minded as was evidenced by the thousands who visited our Purdue house and is being convinced that the low-cost house of the future is the concrete house," said Mr. Schwartz.

Charles Joern of William Joern & Sons, Chicago, gave the masonry manufacturers a detailed account of the Joern system of building and selling concrete houses in the LaGrange Park development west of Chicago. Commenting on their system he said: "With concrete floors we not only eliminated the fire hazard, thereby reducing the fire-insurance rate, but we so strengthened our entire structures and eliminated sagging floors and the possibility of the presence of termites and vermin that this feature became one of our best selling points.

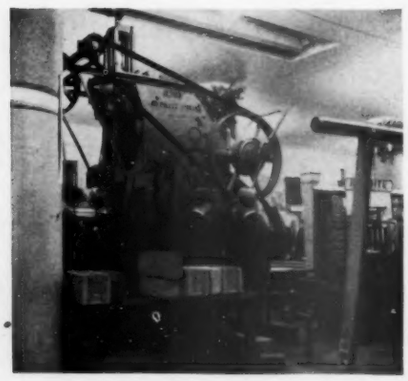
"By building concrete floors and concrete-masonry walls, thus giving the structures longer useful life than most ordinary types of construction could permit, lending interests have expressed greater willingness to grant financial aid to us and the owner."

Paper after paper presented at meetings of the National Concrete Masonry Assn. dealt with manufacturing problems which have confronted concrete-products men. Recent developments in block manufacture held their interest in discussions with curing being the topic of the hour. Curing with steam under high pressure in all its aspects was described by J. C. Vosburgh of Chicago. The possibilities of this method of speeding up block production found competition in another means of rapid curing—electricity. J. Miller Smith of Detroit explained how low-voltage alternating current passed through freshly-made concrete caused heat to be created by the resistance of the moist mix, thus speeding up the curing process. Although this method was first introduced by Swedish engineers five years ago, great strides already have been made in certain European countries, he said.

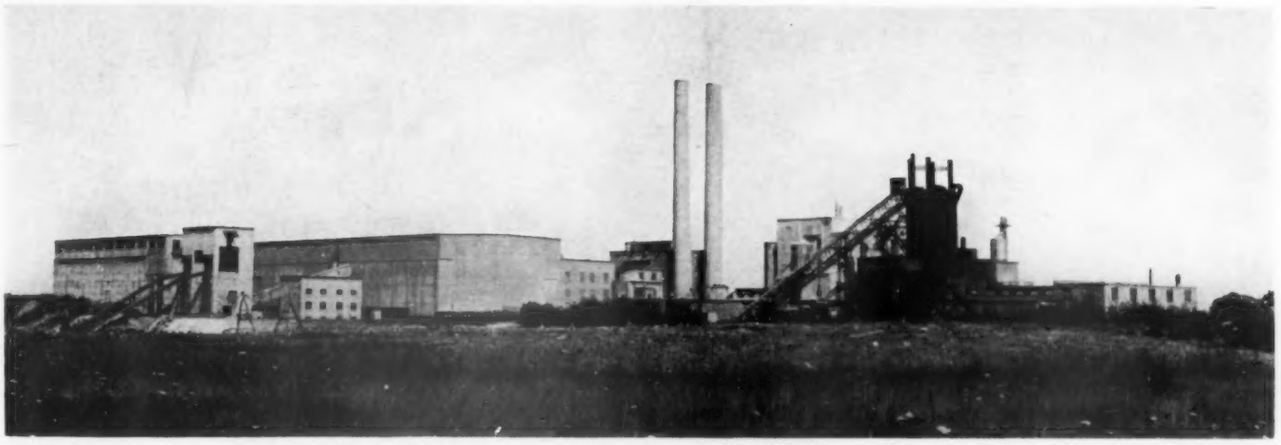
Of immediate interest to cement-products men were the experience stories and discussions on the ways and means of selling concrete houses. To get down to serious selling a good organization is needed. How to set up such an organization was outlined by John L. Strandberg of Kansas City, Mo. W. D. M. Allen, director of promotion of the Portland Cement Assn., told what his organization will do to help with the selling job, while J. M. Cleary, vice-president of Roche, Williams & Cunnyngham, advertising agency, Chicago, spoke of what can be done to cash in on promotional efforts.

The convention was closed with a tentative decision to hold the 1938 National Concrete Masonry Assn. convention in Milwauke, Wis.

Some of the exhibits at the Concrete Industries Exposition. LEFT—Jaeger Machine Co.; RIGHT—Chain-Belt Co.



LEFT—Smith Engineering Works; ABOVE—Besser Manufacturing Co.; RIGHT—Knickerbocker Co.



Thomaston, Me., operations of Lawrence Portland Cement Co. The lime plant is at the right.

Separate Quarry Level Serves Lime Plant of Lawrence Portland Cement Co.

By C. H. SONNTAG
Plant Manager
Lawrence Portland Cement Co.
Thomaston, Me.

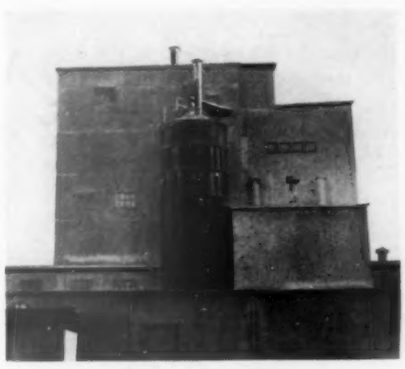
THE manufacture of lime is one of those industries that, in spite of the technologic advances of recent years, has remained in an almost primitive state. The raw material, usually limestone, must be taken as given by Nature. If it is pure and homogeneous both chemically and physically, so much the better. But some lime plants are not so blessed, and must do the best they can with the stone at hand.

The geologic age of a limestone has nothing to do with its availability as a source of lime, but the nature and extent of its impurities and the distribution of those impurities are vital factors. They may allow a stone to be made easily and entirely into a first-class product or into a good lime when proper precautions are taken, or they may render a limestone worthless as a source of lime.

Kilns are larger in diameter and higher than they once were, but essentially they are the same old kilns grown up, with all the weaknesses and idiosyncracies that they inherited from their forebears. We are concerned here with vertical kilns only, and except in size these differ in no important particular from those of fifty years ago.

The commercial limestone of Maine lies in a valley or trough running from Rockland to Thomaston, and forms a deposit roughly 5 mi. long, 1 mi. wide and several hundred feet deep. As were most limestones, this one must have been laid down in horizontal sheets in the bottom of a shallow ocean. But during the earth movements that brought about the formation of the Appalachian range this stone was intensely squeezed and folded and changed into something resembling marble. The folding was so intense that strata once horizontal are now steeply inclined and in places vertical, and overthrusts of unknown displacement are encountered, presenting quarrying problems that have called for special solutions. The folding and uplift were followed by an enormous lapse of time in which erosion was active, and the limestone as it now exists is the remnant of what must once have been a much more extensive deposit.[1]

[1] *Geologic Atlas of the U. S.*, No. 158, Rockland, Maine.



Curing bin at lime plant.

If this stone were uniform in composition and texture, quarrying it would be comparatively simple. Unfortunately the stone is not uniform. Some of it contains less than 75 per cent. of calcium carbonate and is entirely unsuitable for lime-making. Other layers are practically pure and produce an excellent lime. Such stone must be quarried by hand. A group of quarry men has grown up with the local industry and they can detect minute differences that are not noticeable to the casual observer, but which distinguish stones that will not act at all similarly in the kiln.

There has been plenty of time to acquire this knowledge, for the land in this region was the estate of Henry Knox, Washington's Secretary of War. After the Revolution he settled in Thomaston and, among other business ventures, burned lime. Lime-burning has been a part of the industrial life of the community ever since.

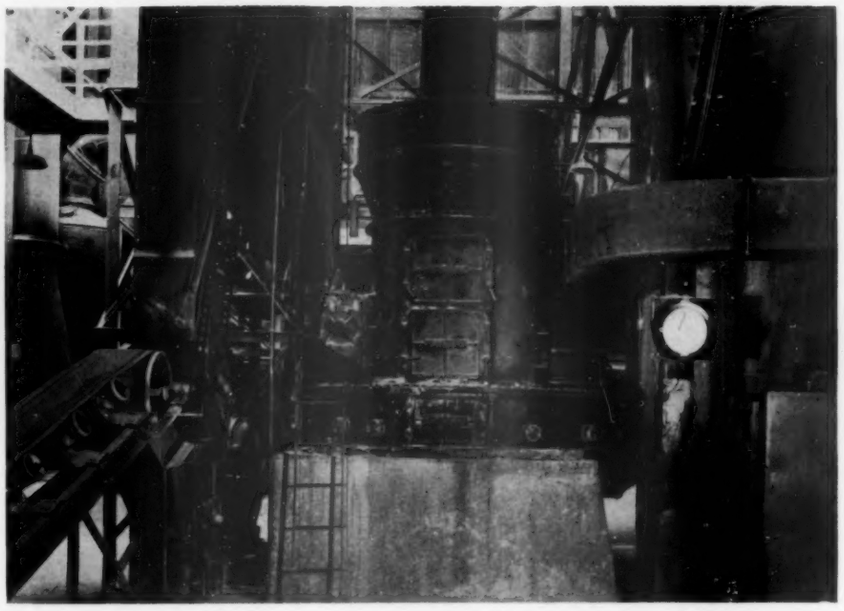
The Lawrence Portland Cement Co. operates a lime plant on the same property with its cement mill and the two plants use the same quarry but different levels of it. In this quarry the upper rock to a depth of 50 ft. or more is so impure that it can not be burned to lime, but it is an excellent raw material for cement making. As it is removed and used for that purpose it uncovers a layer of pure limestone about 60 ft. thick, which is the source of supply for the lime plant. Even this stone must be quarried and sorted by hand. The part not used in the lime kilns is sent to the cement mill.

The lime plant as first built consisted of two large kilns with a capacity of 35 tons each per day, the intention being to supply lime in bulk to paper mills, and to ship the remainder in lump form in barrels for structural and other purposes. A demand for granulated quicklime soon developed, and a Pennsylvania hammer-mill, a Tyler vibrating screen and barrel packers were installed.

It then became apparent that there was a considerable market for hydrated lime in various grades which the company was not prepared to supply, so a Schulthess hydrator and a Gayco air-separator were added, with a later installation of a second separator.

As so made up, the lime plant was a well-balanced operation until two years ago, when a demand for finely-pulverized limestone for agricultural purposes in place of hydrated land lime suddenly became manifest. This was the result of the persistent teaching of the Maine Agricultural Experiment Station that much of the soil on Maine farms is acid, and should be treated with lime to correct that condition. At the same time many farmers came to understand that a given neturalizing power could be bought more cheaply in the form of calcium carbonate than as calcium hydrate. Also it is believed that much Maine soil is deficient in magnesia, and treatment in such cases should be with magnesian rather than high-calcium lime.

It had been realized for some time that the hydrator as originally installed was too short and that the tailings from the air-separators were not properly cleaned. The company was then faced with two problems: (1) the improvement of the hydrating system, and (2) the installation of equipment for producing pulverized limestone. These will be treated separately. It was felt that outside advice on these matters should be had, and at the company's request W. M. Cook of Raymond Bros. Impact Pulverizer Co. spent several days studying the situation, and the changes made were in accordance with his suggestions.



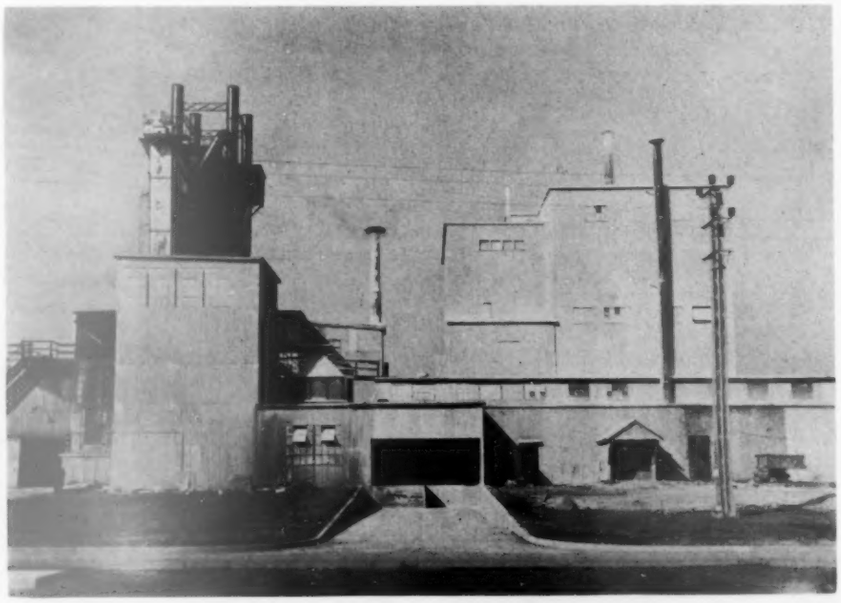
Kiln mill with upper end of stone conveyor, elevator, lower portion of mill feed bin, hot-air duct from furnace, and recording pyrometer.

The Schulthess hydrator, which is of the horizontal shaft-and-paddle type, was originally 21 ft. 6½ in. long, and had an internal screen and an offset stack, both of which had given considerable trouble. The hydrator was followed by two air-separators, one above the other, the feed to the lower being the tailings of the upper. The final tailings went to a small hammer-mill,

Setting the primary and secondary cyclones.

which rejected some of them and returned the rest to the hydrator.

In the rearrangement the hammer-mill, the internal screen and the offset stack were discarded. The hydrator and its paddle shaft were extended to a total length of 30 ft. A "curing bin" with a capacity of 100 tons of hydrate, and to be fed directly from the hydrator, was put in. The idea was to allow the fresh hydrate to "cure" for at least 24 hr. so that the slow-slaking particles might complete their hydration. The hydrate from the curing bin goes through the two air-separators serially, the tailings from the lower one going



General view of the lime plant showing driveway and truck-loading platform.

to a Raymond No. 1 throw-out mill with its own Poole air-separator. The rejects from this mill are practically clean, and contain no marketable hydrate. No tailings are returned to the system.

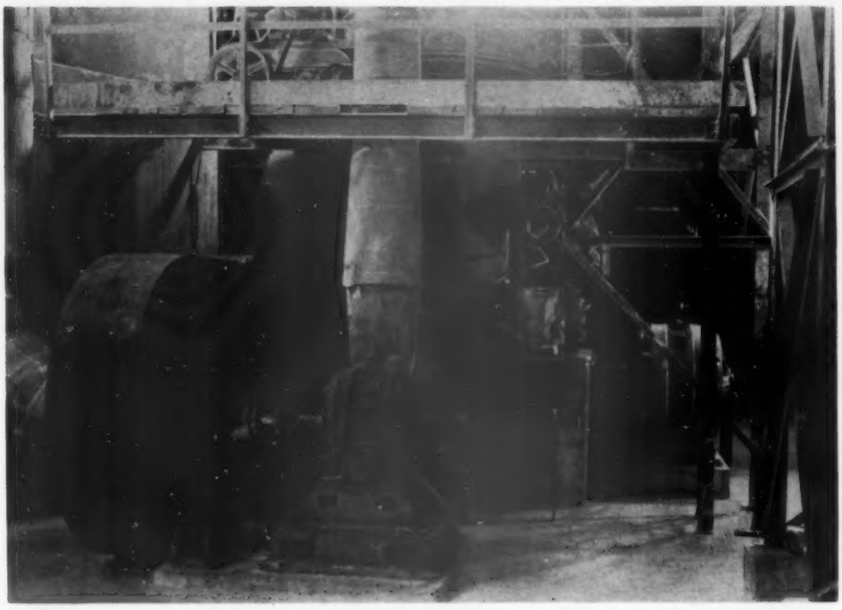
The three air-separators are interconnected in such a way that their products can go to separate bins or two or three of them can be combined to make one product. After some experimenting it has been found possible to make the highest type of hydrate, known in this territory as chemical hydrate, from all three separators, so that all may be making this product at the same time if desired.

The curing bin was supported on a high foundation, so that the operators may walk under the discharge conveyor into which the tank empties through three Raymond feeders. In pouring the high foundation it was found convenient to set the concrete mixer on the roof, and supply materials to it by crane. Of course, the roof was properly braced underneath.

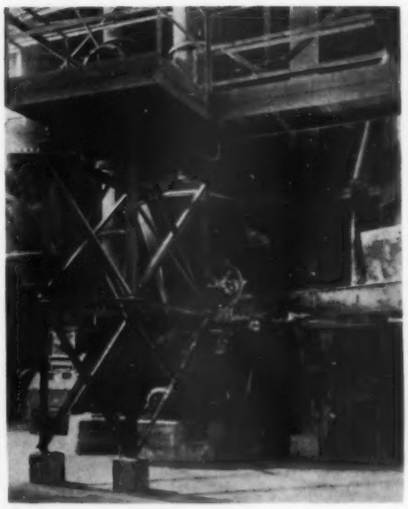
The suction fan that is a part of the throw-out mill installation is on the overhead platform with its direct-connected motor. The throw-out mill was set high enough so that a concrete buggy could be placed under its discharge spout to catch the rejects.

These changes at least doubled the capacity of the hydrator. It has been run at close to 4 tons per hr., but we have not reached or needed its maximum capacity. The product has been greatly improved, and we give credit for this to both the curing bin and the throw-out mill. All the products are shipped in paper bags filled by means of Bates packing machines. They consist of chemical hydrate, masons' hydrate, agricultural hydrate and land lime.

The market served by this mill calls for three kinds of finely-ground raw limestone: high-calcium stone, high-magnesian stone or dolomite, and asphalt filler. Of these the first is obtained from the company's quarry adjacent to the lime plant. The same grade of stone as is burned in the kilns is used, but it may be too small for kiln use. The second is brought by motor trucks from a dolomite quarry some distance away. The third also comes from the company's own quarry, but may be lower in lime, as the chemical composition is not particularly important for asphalt filler.



Kiln mill showing motor, automatic feeder, speed-reducer and V-belt from motor for "whizzer" drive, main and hot-air fans.



Throw-out mill and separator. Chemical-hydrate tank in background.

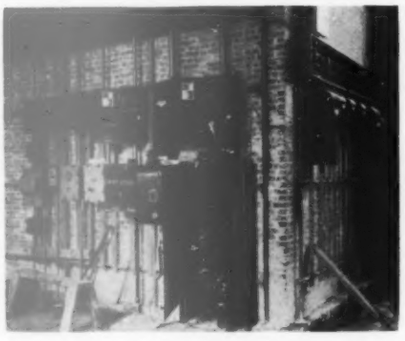
Much of the stone received is in one-man size, and the first reduction to about 1-in., is made by a Good Roads No. 1530 fine-reduction jaw crusher. Its feed opening is 13 in. by 29 in., and it is driven by a 50-hp. motor through an 8-strand Dayton V-belt. The crusher discharges on a 14-in. conveyor belt set on an 18-deg. incline. The upper end of this conveyor empties into an elevator that discharges into the feed bin of the pulverizing mill.

While it might be possible to grind limestone without drying in dry weather, it was important to be independent of this, so a Raymond kiln-mill was installed. It is direct-coupled to a 75-hp. motor, and is of the 5-roller high-side type, with a Raymond "whizzer" built into the top. The whizzer is independently driven through a Reeves

Packing machine beneath ground-stone bin. Sacked material ready for shipment at left.

transmission. The mill is of the air-swept type, and the function of the "whizzer" is to throw out and return to the grinding chamber of the mill particles that are not fine enough. Wide variations in fineness may be had by changing the speed of the "whizzer," which may be done while the mill is in operation.

A small coke-fired furnace was built to supply heat to the kiln-mill. All the gas from the combustion of the coke, as well as much excess air, is drawn into the mill. One of the pictures shows the kiln-mill after two years of operation. The upper end of the belt-conveyor from the crusher may be seen on the left, as well as the elevator into which it discharges, and which in turn discharges into the top of the feed bin. Attention is particularly called to the square duct coming into the picture from the right. This is the flue carrying hot air and combustion gas from the coke-fired furnace to the mill. The



Controllers for motors in lime plant.

furnace may be vented to the atmosphere when the mill is not running. Below the hot-air duct may be seen a round-type recording pyrometer by means of which the operator may always know the temperature of the gas entering the mill. The record is kept for reference, should that be necessary. The temperature is usually kept at 250 deg. F.

When the Raymond mill is used as a kiln-mill, two fans are needed—one large fan which circulates air through the mill and carries out the material when fine enough, separating it in a cyclone and returning the air to the mill, and another smaller one which draws air out of the system and discharges it to the atmosphere through cyclones. The air so withdrawn is replaced by hot air from the furnace which dries the stone as it is ground. The moisture is carried out of the system in the discharge of the second fan.

The main circulating fan is driven by a 50-hp. motor. The smaller one, which withdraws the moisture-laden air, is driven by a 15-hp. motor.

Mechanical complication is avoided by setting the main cyclone of the Raymond mill over the bin for ground stone, but this requires a rather high building, as there is a swinging spout from the bottom of the cyclone which allows the product to go to any one of the four compartments of the bin. In another picture the 75-hp. motor driving the kiln mill can be plainly seen, also the automatic feeder. In the upper left-hand corner above the platform is the Reeves variable-speed transmission that drives the "whizzer." It gets its power through a Dayton multiple V-belt from a motor mounted on the top of the Reeves transmission, this mounting being one of the standard arrangements for such a combination. The main circulating fan and its 50-hp. motor are in the left foreground. The small vent fan is behind the 50-hp. motor, though its own small motor may be seen. It will be noticed that the air pipes are covered with burlap and roofing paper. This is a cheap and satisfactory covering, and prevents condensation in the pipes when much water is being evaporated. The cyclones are similarly covered.

The ground-stone bin is circular with a total capacity of 200 tons, and has two partitions at right angles, forming four 50-ton bins. In this way four different commodities can be stored, though usually only three are made. Gates from each of these compartments open into a small closed hopper over a 2-spout Bates packer.

The "whizzer" has shown itself capable of producing a wide range of fineness. Agricultural stone is usually ground to 87 per cent. through the 200-mesh sieve, but on occasion limestone has been ground in this installation to 99.8 per cent. passing the 325-mesh sieve, though of course at much reduced capacity. The only thing necessary to be done to get this range is to change the speed of the "whizzer," which is accomplished by turning a hand-wheel while the machine is running. Much coarser grinding can be done if desired.

The air-separators and their associated Link-Belt conveyors and elevators in the hydrate plant are group-driven by a single 25-hp. motor. The pulleys are large and the belt speeds high. Experience has shown that it does not pay to economize on first cost by using small pulleys and tight slow-speed belts, and paying dearly for that saving in slipping and broken belts.

All starting and protective devices, for both the hydrate and ground-stone plants, are grouped. The only thing near the motor or driven machine is a start-and-stop push-button. Practically all the other machines, except those in the group drive mentioned, have their individual motors, and where desirable they are electrically interlocked in sequence. The motors, most of which have Timken bearings, were furnished by Allis-Chalmers and most of the controls by Cutler-Hammer. Falk-Bibby flexible couplings are used.

The electrical force of the cement mill is available for inspection and such infrequent repairs or adjustments as may be necessary.

There have been occasional calls for ground stone to be shipped in bulk in box-cars, as cement is. For such cases a pipe spout is run from the cyclone of the Raymond mill direct to the door of the car. The slope is such that the powder runs freely, and the car is loaded direct from the mill as fast as the latter can grind.

Much of the agricultural lime, both hydrate and ground stone, is taken away in motor trucks operated by their owners. Loading these from the floor level is costly and somewhat hazardous. To avoid this a drive was recently built into the lime plant from the main roadway of the cement mill. It was found possible to make this drive self-draining and still have its inner end low enough so that the floor of a truck standing there is flush with the floor of the lime plant. Packages on bag trucks can now be wheeled directly into motor trucks and dumped there, considerable labor being thus saved.

All construction was done by the company's own men, including the erection of the curing and ground-stone bins, which are electrically-welded throughout. Electric welding was also extensively used in other parts of the work. The addition to the building was erected by the New England Structural Co. of Everett, Mass.

Czechoslovakia Imports Most of Its Asbestos

Asbestos is produced in Czechoslovakia only at Dobsina, in the Gemer district of Slovakia, and in limited quantities, averaging about 2,000 tons annually; about one-fourth of the output has been exported in recent years, says *Mineral Trade Notes*. The home product, however, is of short fiber, while imports are generally of long-fiber asbestos. After declining to 3,403 metric tons in 1935, Czechoslovak imports of asbestos are increasing, the quantity imported in the first eight months of 1936 being substantially higher than the total for either 1935 or 1934. Soviet Russia and Canada are the principal countries of origin, and fairly large transit shipments have also been received *via* the Free Port of Hamburg.

Aërial view of Peoria Lock on Illinois River showing progress which has been made in its construction. In the foreground are three aggregate barges and the concrete plant. In the left foreground a cement barge is tied up for unloading.

Handling Cement and Aggregate on Lakes-to-Gulf Waterway Lock

View inside cofferdam. Crane at right is unloading aggregates from barges to the storage bins at the mixing-plant.

The remote-controlled portable unloader transferring cement from barge to mixing-plant bins.

THE many large government construction projects which are under way or have been completed in recent years have provided many developments of interest to producers of nonmetallic minerals. Some have received publicity in PIT AND QUARRY because of the magnitude of their aggregate-producing operations and others because of their economical and efficient processing and handling methods which can be applied to commercial operations. This article is concerned with a project coming under the latter classification.

The Great Lakes Dredge & Dock Co., Chicago, Ill., has the contract for the construction of the Peoria Lock in the Illinois River, which is a part of the Great Lakes-to-the-Gulf deep waterway system. The methods used in handling cement and aggregates to the concrete-mixing plant are unusually interesting. The lock was about 30 per cent. completed when construction was recently suspended for the winter. The cofferdam covers an area of 9½ acres and involves 300,000 cu. yd. of excavation and 60,000 cu.yd. of concrete. It is 1,100 ft. long and is of cellular steel construction on the river side. The contract for the dam which will complete this project will be let this year.

Cement, of which about 66,000 bbl. will be used in the construction of the cofferdam, is received in barges of 1,800-bbl. capacity each from the plant of the Universal Atlas Cement Co. at Buffington, Ind. The barges are tied at the cofferdam near the concrete plant for unloading. The bulk cement is taken from the barges by means of a Fuller-Kinyon automatic remote-control unloader of the type recently described in PIT AND QUARRY. This machine, which went into operation early in August, 1936, has a capacity of 115 bbl. per hour and has been transporting cement through a distance of 413 ft. to the concrete-mixing plant with no trouble of any kind, according to W. B. Murray, superintendent of the contracting company.

The economy of this method of handling cement was demonstrated during a period of several weeks when Lake Michigan was too rough for barge shipments. During this period sacked cement was shipped to Peoria by railway and was delivered to the barges in the river by motor trucks. The sacks were then emptied into the barges which where subsequently emptied with the portable unloader at the lock. This was done, it is said, at a lower cost than if the cement had been sent by trucks from the railroad direct to the mixing plant, which is 4½ mi. downstream from Peoria.

This portable unloader (see P & Q, Aug. 1936, pp. 58-59) is an improvement on the manually-controlled unloader which has been made by the Fuller Co. for many years. The new machine eliminates all danger of any kind to the operator from the unloading of

bulk cement, as he can remain at a safe distance out of reach of any possible slides. This remote-control feature is also considered important by Great Lakes officials because of occupational-disease legislation recently enacted in Illinois.

While the unloader creates little dust in operation, the occasional cement slides formerly experienced sometimes made it necessary for the operator to wear a respirator. Remote control eliminates this necessity. At this particular job the operator often sits for hours on the deck of the barge at the edge of one of the hatches enjoying the sunshine and fresh air while the unloader carries on below. Only occasionally does the operator need to enter the barge to check the oil seal, etc.

Air for this unloader is supplied by a Fuller rotary compressor which supplies the desired amount of free air at 35-lb. pressure at the compressor and about 32-lb. at the unloader. The transport-line pressure varies, but is usually about 25 lb. The cement is discharged into a 120-bbl. bin at the concrete plant.

The sand and gravel used in the concrete are shipped by barge from the new sand-and-gravel plant of the Kingston Lake Gravel Co. at Lacon, Ill. A crawler crane transfers these materials from the barges to four 40-ton bins at the concrete plant.

In the mixing plant a screw feeder discharges cement from the bin into a Blaw-Knox 1,000-lb. weigh-batcher equipped with a Winslow beam scale and indicator. Aggregates are discharged through clam-shell gates into a 3,600-lb. batcher. Water is measured in a 110-gal. Blaw-Knox tank. These ingredients are discharged into two Chain-Belt Rex 1-cu.yd. drum-type mixers which empty into Blaw-Knox 32-cu.ft. concrete buckets on cars. Plymouth 4½-ton gasoline locomotives haul these cars to the forms, where a crane handles and dumps the buckets.

This concrete plant is producing 1,000 cu.yd. of concrete in a 24-hr. day.

Second I.A.T.M. Congress in London in April

The second congress of the International Association for Testing Materials will be held April 19-24 in London, England. Included in the 150 papers scheduled for presentation are a number of American technologists. *Testing Aggregates for Durability in Concrete* by A. T. Goldbeck of the National Crushed Stone Assn., and *Volume Changes in Concrete* by F. R. McMillan, director of research, Portland Cement Assn., are two that have been announced.

Diesel Dredge Serves New Plant

An interesting sand plant of small capacity was put in operation Nov. 15, 1936, by the Happe Hale Sand & Gravel Co., Muncie, Kan. The plant is on the north bank of the Kaw River about 8 mi. west of Kansas City, Mo. and is supplied by a dredge operating in the river. The partners in this business are R. J. Happe and Wm. Hale, who have had 20 years of experience in sand-and-gravel production on this river.

The dredge hull was made from two halves of an 8-ft. by 32-ft. oil tank of ¼-in. steel. The tank was cut longitudinally and a center bulkhead was installed in each half. The dredge floor is laid on twelve 5-in. by 9-in. timbers which are fastened to the pontoons with angle irons. The two pontoons are 3 ft. apart and part of this gap was left open to form a well for the dredge-pump nozzle. A 2-ft. pipe nozzle is now used but a 4-ft. nozzle will be installed after the dredge has dug its way out into midstream. The new Kansas City Hay Press Co. "Lightning" standard 6-in. dredge pump is driven by a 4-cyl. 60-hp. Fairbanks-Morse Diesel engine through a flat belt. A Sterling 2-drum hoist for operation of the nozzle and a shoreline is belt-driven from a pulley on the end of the pump shaft. A Fairbanks-Morse water pump for priming

The dredge with its hull made of the two halves of a tank.

the dredge pump and cooling the engine is also driven from this engine. A Fairbanks-Morse compressor for starting the Diesel engine is driven by a gasoline engine.

The material is at present being pumped about 200 ft. from the dredge to the plant, which is at the top of the steep river bank. The material and water are discharged from the pipeline on a grizzly having the same slope. This grizzly removes gravel, mud balls, etc., which are being used to build a road from the plant to the state highway. The material passing through the grizzly drops on an 18-mesh inclined stationary screen. The material that passes through this screen is brick or molding sand and the coarse material retained on it goes over it fast enough to retain sufficient fines for concrete sand. Each of the two sizes of sand is discharged on a separate stock-pile.

A ¾-cu. yd. V-shaped scraper operated by a 2-drum Sterling hoist pow-

Interior of dredge while under construction showing pump and Diesel engine.

ered by a 40-hp. Waukesha gasoline engine moves these materials to two stock-piles of 5,000 cu. yd. capacity each on opposite sides of the plant. The hoist-house is on a direct line with the dredge line and plant and the scraper is operated at right angles to this line by two sheaves and two tail pulleys on 50-ft. timber masts 175 ft. from these pulleys. The drag bucket is used for handling material both to and from storage by reversing the cable connections.

The two stock-piles are formed over tunnels which have been dug 10 ft. deep and are covered by a roof having two tunnel gates about 3 ft. above ground-level. Trucks are loaded by being backed into these tunnels. When each stock-pile is built up to its full height the live loading capacity is about 75 tons. This system makes possible the storage of sufficient material to take care of all demands through the winter.

The partners, Wm. Hale, left, and R. J. Happe, right.

By JOHN SHIPMAN

The Quaternary System [CaO-Al_2O_3-SiO_2-Fe_2O_3] and the Lime-Saturation Index of Cement

FOR business reasons the author of this discussion prefers that it appear under a nom de plume. He is the physical chemist at a large cement mill in the Lehigh District, highly regarded in the industry for his studies and research in the technique of cement manufacture. This is his second paper on the subject, the first having appeared in the July, 1936, issue.

PORTLAND-CEMENT research has definitely proved that in the quaternary system of lime, silica, alumina, and iron oxide the compounds formed under conditions of equilibrium are: Tri-calcium silicate, di-calcium silicate, tri-calcium aluminate, and tetra-calcium-alumino-ferrite. For the most part these compounds are formed provided that the conditions for cooling are satisfactory. In an investigation of the quaternary system CaO-Al_2O_3-SiO_2-Fe_2O_3, Messrs. Lea and Parker[1] have shown that improper cooling of clinker will result in the formation of a glass or small amounts of 5 CaO. 3 Al_2O_3.

In a previous discussion [2] the writer more or less proved mathematically that these conclusions could be applied without appreciable error to all conditions of commercial practice. In this discussion several formulæ were developed which agreed quite closely with the formulæ of Lea and Parker.

In the design and control of Portland-cement mixes from a manufacturing standpoint it is generally the policy of the laboratory to establish some lime standard or acid standard commensurate with quality and thus regulate the mix to comply with these values. In the past these standards were established from plant experience and often without regard to the possibilities of improvement of cement quality. However, within the past few years with the ever-increasing demand for cements of special design more attention has been focussed on the possibilities and practicabilities of such changes. In an effort to determine the best possible mix from a theoretical and practical viewpoint the writer has made a mathematical investigation of several cement mixes. These mixes to be sure only represent a very small portion of the quaternary system CaO-SiO_2-Al_2O_3-Fe_2O_3 composed of an infinite number of combinations and variations.

As a basis of the investigation the optimum mix indicated in the previous discussion [2] was used, or:

$$CaO = 2.536\,SiO_2 + 1.63\,Al_2O_3 + 0.36\,Fe_2O_3. \quad (1)$$

It will be recalled that these factors were determined by solving the equations developed, thus:

Let X = percentage of C_3S,
$100 - X$ = percentage of C_2S.

Then
$$2.800\,X + 1.867\,(100 - X) = \text{Lime} \div \text{Silica Factor},$$
$$0.933\,X + 1.867 = \text{Lime} \div \text{Silica Factor} \quad (2)$$

Then if the right-hand side of the equation were represented by the $C_3S \div C_2S$ ratio or, $X \div (1.00 - X)$, it was found that the two sides of the equation were equal for X at 71.7 per cent., corresponding to a Lime ÷ Silica Factor of 2.536.

Similarly it was shown that:

$$\text{Lime} \div \text{Alumina Factor} = \frac{1.262\,(K - 0.072)}{K - 0.424} \quad (3)$$

where K = Alumina Modulus = $Al_2O_3 \div Fe_2O_3$

And if K were substituted for the Lime ÷ Alumina Factor it was found that the two sides of the equation were equal for K at 1.63. Hence the completed equation.

In the present investigation it was found that equation (3) did not satisfy the calculated conditions of independent crystallization. However, by the solution of simultaneous equations it may be shown that equation (3) would be modified to:

$$\text{Lime} \div \text{Silica Factor} = \frac{1.176\,(K - 0.28)}{K - 0.649} \quad (4)$$

Therefore, equation (1) should read as follows:

$$CaO = 2.536\,SiO_2 + 1.622\,Al_2O_3 + 0.37\,Fe_2O_3. \quad (5)$$

Consequently the optimum condition is changed from 1.63 to 1.622. The errors involved are about 0.2 per cent. in the extreme cases, which is not too great since the compound compositions are at best mere approximations.

As a starting point it was felt that the various oxide ratios may have an important bearing on the design of any one mix. With this thought in mind five mixes, "a," "b," "c," "d," and "e," were calculated, as shown in Table I. Realizing that the percentage of liquid formed would have a direct bearing on the burning conditions, the equation representing the amount of liquid at 1,400 deg. C. from Lea and Parker's investigation was used:

$$\text{Liquid at 1,400 deg. C.} = 2.95\,Al_2O_3 + 2.2\,Fe_2O_3. \quad (6)$$

It was felt also that the heat of formation, or the exothermic reaction, may have some bearing upon the burning and hence the results of T. Thorvaldson *et al.*[3] were used:

C_3S = 258.3 B.t.u. per lb.
C_2S = 347.4 B.t.u. per lb.
C_3A = 138.6 B.t.u. per lb.

The $SiO_2/Al_2O_3 + Fe_2O_3$ ratio, which will be designated as the acid modulus, was plotted against values of liquid and heat of formation but no simple relationship appeared. It was then felt that the two may be combined in some manner. As a result, the Ratio of the Heat of Formation ÷ the Percentage of Liquid Formed, which will be designated as the Burnability Index, was found to be nearly proportional to the Acid Modulus (Fig. 1). As a matter of fact, the relationship is very nearly a straight line over the entire range from 0 to Inf., while for the region of normal Portland cements the line is definitely straight. Similarly, the Burnability Index was plotted against the $CaO/SiO_2 + Al_2O_3 + Fe_2O_3$ and

CaO/SiO_2 ratio, but no simple relationship was determined. It was, however, found that these oxide ratios intersected at some point, and it was concluded that these conditions were satisfied when:

$$\frac{CaO}{SiO_2 + Al_2O_3 + Fe_2O_3} = \frac{SiO_2}{Al_2O_3 + Fe_2O_3} \text{ (mix "f")}, \quad (7)$$

$$\text{and } \frac{CaO}{SiO_2} = \frac{SiO_2}{Al_2O_3 + Fe_2O_3} \text{ (mix "g")}. \quad (8)$$

The former represented the minimum condition, while the latter represented the maximum condition for a satisfactory cement. In other words, it may be stated that for a given Lime-Saturation Index Equation the region of a satisfactory cement lies between the ratio as given by (7) and (8). Mix "h" represents the average between "f" and "g" and hence may be considered the optimum condition for the particular Lime-Saturation Index Equation.

In Table I all the data pertaining to the oxide composition are shown. In this investigation the Bogue method [4] of compound composition was used in so far as the C_3A and C_4AF were concerned. However, in the calculation of the C_3S and C_2S contents equation (2) was used. The C_3S content was found by calculating the actual Lime ÷ Silica ratio, (the lime in any event was considered after the SO_3, C_3A and C_4AF were calculated). The amount of C_3S was then found by solving the equation for X and multiplying this value by the summation of the lime and silica or the total silicates. The C_2S was, of course, found by difference. This is not intended as a criticism of the Bogue method of calculation of the C_3S and C_2S contents, but it does satisfy the conditions for which the optimum value of Lime ÷ Silica is derived. As another proof it may be shown that when the Lime ÷ Silica Factor is 2.333, or the mean of the ratios between 2.800 and 1.867, the calculated amount of C_3S and C_2S are 50 per cent. respectively. This is not the case with the Bogue method, as shown:

$$CaO \div SiO_2 = 2.333$$
$$CaO = 70.00$$
$$SiO_2 = 30.00$$

Author's method:

$$0.933\,X + 1.867 = CaO \div SiO_2 = 2.333$$

$$X = \frac{2.333 - 1.867}{0.933} = 50 \text{ per cent.}$$

Bogue method:

$$C_3S = 4.07 \times 70.00 - 7.60 \times 30.00 = 56.9\%$$
$$C_2S = 8.60 \times 30.00 - 4.07 \times 70.00 = 43.1\%$$

The difference between the two methods becomes greater as the $CaO \div SiO_2$ ratio approaches 2.333. The two methods, of course, agree for a maximum of C_3S or C_2S, in which case the ratios are 2.800 and 1.867, respectively.

The independent crystallization is shown in the lower bracket of Table I and the consequent effect upon the compound composition ratios. It will be observed that the $C_3S \div C_2S$ ratio approaches the designed value of the Silica-Saturation Modulus ($C_3S \div C_2S = CaO \div SiO_2$), when the mix forms C_5A_3 upon cooling.

Following the same methods as previously outlined, the mixes were designed with varying ratios of the Alumina Modulus from 0.638 to Inf., and for different Lime-Saturation Index Equations. In all this work the same general relationship appeared, *viz.*, the

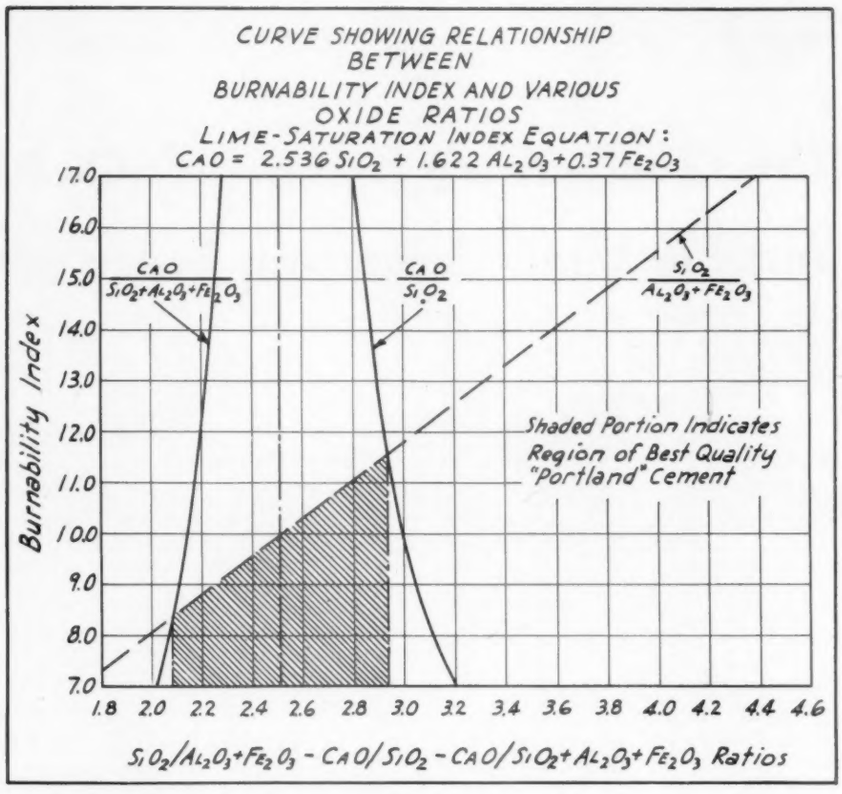


Fig. 1.

TABLE I.—LIME SATURATION INDEX EQUATION:
$CaO = 2.536\,SiO_2 + 1.622\,Al_2O_3 + 0.37\,Fe_2O_3$

Mix	a	b	c	d	e	f	g	h
CaO	68.18	68.45	67.22	69.47	67.20	68.57	67.58	68.15
SiO_2	22.82	23.25	21.35	24.81	21.31	23.43	21.91	22.77
Al_2O_3	5.57	5.14	7.07	3.54	7.10	4.95	6.50	5.62
Fe_2O_3	3.43	3.17	4.36	2.18	4.38	3.05	4.01	3.46
C_3S	57.45	58.42	53.55	62.68	53.56	58.98	55.06	57.33
C_2S	23.15	23.66	21.81	24.99	21.69	23.78	22.30	23.10
C_3A	8.96	8.27	11.37	5.70	11.42	7.95	10.44	9.04
C_4AF	10.44	9.65	13.27	6.63	13.33	9.28	12.20	10.53
C_3S/C_2S	2.482	2.469	2.455	2.508	2.469	2.480	2.469	2.481
C_4AF/C_3A	1.165	1.167	1.167	1.163	1.167	1.167	1.169	1.165
A/F	1.622	1.622	1.622	1.622	1.622	1.622	1.622	1.622
S/A+F	2.536	2.800	1.867	4.337	1.856	2.929	2.085	2.507
S/A	4.097	4.523	3.020	7.008	3.000	4.733	3.371	4.051
S/F	6.653	7.334	4.897	11.381	4.865	7.682	5.464	6.581
C/S+A+F	2.143	2.169	2.051	2.275	2.049	2.182	2.085	2.140
C/S	2.988	2.944	3.148	2.800	3.153	2.927	3.084	2.993
C/A	12.241	13.317	9.508	19.624	9.465	13.853	10.397	12.126
C/F	19.878	21.593	15.417	31.866	15.342	22.482	16.853	19.697
Heat of Formation	241.0	244.3	229.6	256.4	229.3	245.7	234.0	240.6
% Liquid Formed	23.98	22.13	30.45	15.24	30.59	21.31	28.00	24.19
Burnability Index	10.05	11.04	7.54	16.82	7.50	11.53	8.36	9.95
C_3S	57.96	58.85	54.13	62.91	54.22	59.41	55.55	57.74
C_2S	22.75	23.34	21.36	24.83	21.17	23.45	21.93	22.79
C_3A	8.63	7.97	10.97	5.49	11.01	7.67	10.08	8.71
C_5A_3	0.22	0.19	0.27	0.14	0.27	0.19	0.24	0.22
C_4AF	10.44	9.65	13.27	6.63	13.33	9.28	12.20	10.53
C_3S/C_2S	2.547	2.521	2.534	2.534	2.561	2.533	2.533	2.534
$C_4AF/C_3A+C_3A_3$	1.180	1.182	1.181	1.178	1.182	1.181	1.182	1.179

a = S/A+F = 2.536
b = S/A+F = 2.800
c = S/A+F = 1.867
d = C/S = 2.800
e = S/A = 3.000
f = S/A+F = C/S
g = S/A+F = C/S+A+F
h = Mean of "f" and "g"

direct variation of the Burnability Index with the Acid Modulus.

In Tables II, III, and IV are shown the calculated mean of the ratios: $CaO/SiO_2 + Al_2O_3 + Fe_2O_3 = SiO_2/Al_2O_3$ and $CaO/SiO_2 = SiO_2/Al_2O_3 + Fe_2O_3$ for each Lime-Saturation Index Equation.

Table II, Equation:

$$CaO = 2.536\,SiO_2 + 1.65\,Al_2O_3 + 0.35\,Fe_2O_3 \quad (9)$$

Table III, Equation:

$$CaO = 2.536\,SiO_2 + B\,(Al_2O_3 - 0.638\,Fe_2O_3) + 1.40\,Fe_2O_3,$$

$$\text{where } B = \frac{1.176\,(K - 0.28)}{K - 0.649}, \quad (10)$$

$$\text{and } K = Al_2O_3 \div Fe_2O_3.$$

Table IV, Equation:

$$CaO = 2.80\,SiO_2 + 1.18\,Al_2O_3 + 0.65\,Fe_2O_3. \quad (11)$$

The last equation (11) was given by Lea and Parker as the result of their investigation of the Quaternary System $CaO - Al_2O_3 - SiO_2 - Fe_2O_3$, and was supposed to represent the maximum amount of lime that could be maintained in any mix without "Free Lime" appearing in the clinker. This equation proved to be quite interesting in that it was shown that with an increase of the Alumina Modulus there was a notable decrease in the $C_3S \div C_2S$ ratio. In other words, by increasing the $Al_2O_3 \div Fe_2O_3$ ratio it is possible to avoid the dangers of "Free Lime" in the clinker. This holds true only if the conditions of equilibrium are maintained. On the other hand, if it is assumed that independent crystallization takes place upon cooling, then an optimum condition exists at or near the Alumina Modulus of 1.622. (See Mix XX, Table IV.)

From an anaylsis of Table III it may be seen that under conditions of independent crystallization the Silica-Saturation Modulus is practically constant, or the $C_3S \div C_2S$ ratio is nearly the same over the entire range of varying $Al_2O_3 \div Fe_2O_3$ ratios. Therefore, Lea and Parker's equation may be modified to read as follows:

$$CaO = 2.80\,SiO_2 + B\,(Al_2O_3 - 0.638\,Fe_2O_3) + 1.40\,Fe_2O_3, \quad (12)$$

where B has the same significance as before.

This equation applies to an Alumina Modulus from 1.566 to Inf., while from 0.638 to 1.566 the original equation (11) must be used.

In order to have some method of comparison from a physical testing standpoint, the data from each of the equations outlined above was applied to conditions of testing "A," "B," "C," "D," and Percentage of Contraction, as shown in Tables V, VI, VII, and VIII. The physical data except "D" were obtained from the paper, *Study of Cement Composition in Relation to Strength, Length Changes, Resistance to Sulphate Waters and to Freezing and Thawing, of Mortars and Concrete,* by H. F. Gonnerman and is reproduced here by special permission from the author.[5] The data outlined in the above paper were calculated from 57 cements of nearly the same MgO content and having 1 per cent. or less of "Free Lime."

TABLE II.—LIME SATURATION INDEX EQUATION:
$CaO = 2.536\,SiO_2 + 1.65\,Al_2O_3 + 0.35\,Fe_2O_3$

Mix	I	II	III	IV	V	VI	VII	VIII
CaO	67.13	67.65	68.01	68.18	68.38	68.71	69.32	69.65
SiO_2	23.21	22.99	22.83	22.76	22.67	22.51	22.23	22.08
Al_2O_3	3.76	4.68	5.31	5.61	5.97	6.58	7.68	8.27
Fe_2O_3	5.90	4.68	3.85	3.46	2.98	2.19	0.77	0.00
C_3S	58.83	58.28	57.88	57.70	57.46	57.08	56.36	55.98
C_2S	23.22	23.00	22.85	22.77	22.68	22.53	22.25	22.09
C_3A	0.00	4.48	7.55	9.01	10.79	13.73	19.05	21.92
C_4AF	17.95	14.24	11.72	10.53	9.07	6.66	2.34	0.00
C_3S/C_2S	2.536	2.533	2.533	2.534	2.534	2.534	2.533	2.534
C_4AF/C_3A	Inf.	3.179	1.552	1.169	0.841	0.485	0.123	0
A/F	0.638	1.00	1.38	1.622	2.00	3.00	10.00	Inf.
S/A+F	2.403	2.456	2.492	2.509	2.531	2.565	2.633	2.669
S/A	6.173	4.912	4.299	4.057	3.797	3.421	2.895	2.669
S/F	3.934	4.912	5.930	6.578	7.607	10.279	28.870	.....
C/S+A+F	2.042	2.091	2.126	2.142	2.163	2.197	2.259	2.295
C/S	2.892	2.943	2.979	2.996	3.016	3.052	3.118	3.154
C/A	17.853	14.455	12.808	12.153	11.454	10.442	9.026	8.422
C/F	11.377	14.455	17.665	19.705	22.946	31.374	90.026	.....
Heat of Formation	232.4	236.4	239.1	240.4	241.9	244.5	249.1	251.5
% Liquid Formed	24.07	24.11	24.13	24.16	24.17	24.23	24.35	24.40
Burnability Index	9.66	9.81	9.91	9.95	10.01	10.09	10.23	10.31
C_3S	58.83	58.28	57.88	58.02	60.36	64.30	71.49	75.48
C_2S	23.22	23.00	22.85	22.52	20.44	16.88	10.35	6.78
C_3A	0.00	4.48	7.55	8.70	8.65	8.57	8.44	8.37
C_4A_3	.....	.....	.....	0.22	1.48	3.59	7.38	9.42
C_4AF	17.95	14.24	11.72	10.53	9.07	6.66	2.34	0.00
C_3S/C_2S	2.536	2.533	2.533	2.576	2.953	3.809	6.907	11.124
$C_4AF/C_3A+C_4A_3$	Inf.	3.179	1.552	1.180	0.895	0.548	0.148	0.00

TABLE III.—LIME SATURATION INDEX EQUATION:
$CaO = 2.536\,SiO_2 + B\,(Al_2O_3 - 0.638\,Fe_2O_3) + 1.40\,Fe_2O_3$

Mix	IX	X	XI	XII	XIII	XIV	XV	XVI
CaO	67.13	67.65	68.01	68.15	68.16	68.18	68.22	68.25
SiO_2	23.21	22.99	22.83	22.77	22.76	22.75	22.74	22.72
Al_2O_3	3.76	4.68	5.31	5.62	6.05	6.80	8.22	9.03
Fe_2O_3	5.90	4.68	3.85	3.46	3.03	2.27	0.82	0.00
C_3S	58.83	58.28	57.88	57.33	54.95	50.91	43.30	39.21
C_2S	23.22	23.00	22.85	23.10	24.91	28.00	38.80	36.86
C_3A	0.00	4.48	7.55	9.04	10.92	14.18	20.41	23.93
C_4AF	17.95	14.24	11.72	10.53	9.22	6.91	2.50	0.00
C_3S/C_2S	2.534	2.533	2.533	2.482	2.206	1.818	1.281	1.064
C_4AF/C_3A	Inf.	3.179	1.552	1.165	0.844	0.487	0.122	0
A/F	0.638	1.00	1.38	1.622	2.00	3.00	10.00	Inf.
S/A+F	2.403	2.456	2.492	2.507	2.507	2.510	2.514	2.517
S/A	6.173	4.912	4.299	4.051	3.762	3.346	2.766	2.517
S/F	3.934	4.912	5.930	6.581	7.512	10.022	27.731	.....
C/A+F+S	2.042	2.091	2.126	2.140	2.141	2.143	2.147	2.150
C/S	2.892	2.943	2.979	2.993	2.995	2.997	3.000	3.004
C/A	17.853	14.455	12.808	12.126	11.266	10.026	8.299	7.558
C/F	11.377	14.455	17.665	19.697	22.495	30.035	83.195	.....
Heat of Formation	232.4	236.4	239.1	240.6	243.4	248.2	257.4	262.3
% Liquid Formed	24.07	24.11	24.13	24.19	24.52	25.05	26.05	26.64
Burnability Index	9.66	9.81	9.91	9.95	9.93	9.91	9.88	9.67
C_3S	58.83	58.28	57.88	57.74	57.73	58.09	58.37	58.64
C_2S	23.22	23.00	22.85	22.79	22.79	22.45	22.19	21.93
C_3A	0.00	4.48	7.55	8.71	8.77	8.86	9.04	9.14
C_4A_3	.....	.....	.....	0.23	1.49	3.69	7.90	10.29
C_4AF	17.95	14.24	11.72	10.53	9.22	6.91	2.50	0.00
C_3S/C_2S	2.536	2.533	2.533	2.534	2.533	2.588	2.630	2.674
$C_4AF/C_3A+C_4A_3$	Inf.	3.179	1.552	1.178	0.899	0.551	0.148	0

$$B = \frac{1.176\,(K - 0.28)}{K - 0.649}$$

Where $K = Al_2O_3 \div Fe_2O_3$

"These raw materials consisted essentially of limestone and clay. In a number of cases, however, flint, bauxite, iron ore or dolomite were introduced in order to bring the mixture to the desired composition.

"The raw materials were ground to a fineness of 95 per cent. through the No. 200 sieve, formed into $\frac{3}{16}$- to $\frac{7}{16}$-in. balls which were burned in a gas-fired rotary kiln 5 in. in internal diameter and 8 ft. long, having a capacity of 10 to 15 lb. of clinker per hr. The temperature of burning for complete combination of the various raw mixes was predetermined by means of auxiliary tests in a small electrically-heated furnace. The proper burning temperature and rate of burning to give substantially complete combination were then maintained during the burning of the various clinkers in the rotary kiln. . . . After burning the clinkers were cooled in an open can, passed through rollers and then ground in an 18-in. by 30-in. ball-

mill with the proper amount of gypsum to give constant SO_3 content in the cement.

"All the cements . . . had the same SO_3 content, 1.8 per cent. by weight, and in general contained the same amount of MgO, approximately 3 per cent. by weight.

"All the cements were ground to essentially the same fineness as determined by the No. 200 sieve—87.5 per cent. passing. The specific surface by the (Wagner) turbidimeter ranged from 1,330 to 1,960 and averaged 1,580 sq. cm. per g.

"Strength Tests:

"A: 2-in. plastic-mortar cubes of 1:2.75 mix by weight (water-cement ratio 0.53 by weight) at ages of 1, 3, 7, and 28 days, 3 months, 1 year, and 2 years. Cubes stored in water after 28 days in moist room.

"B: 3-in. by 6-in. concrete cylinders of 1:2.4:3.6 mix by weight (water-cement ratio 0.56 by weight) at ages of 28 days and 1 year. Cylinders stored in air outdoors, and in water in laboratory after 28 days in moist room.

"C: 1:3 standard sand briquets, ages and storage same as for 2-in. cubes.

"Percentage of Contraction: 3-in. by 3-in. by 15-in. Elgin sand-mortar bars of 1:3.6 mix by weight, 1 day in sealed mold, then 7 days in moist room and 11¾ months storage in air."

The data pertaining to "D," or the heat of hydration, were obtained from the text, *The Chemistry of Cement and Concrete,* by F. M. Lea and C. H. Desch.[6]

The data in the following tables refer to cements ground to an average fineness recorded as a surface area of about 1,500 sq. cm. per gram.

In the application of the above data to the mathematically designed mixes it was assumed that the resulting cement had 3.00 per cent. MgO, 1.75 per cent. SO_3, and 1.25 per cent. Misc. (loss on ignition, alkalies, inert substances, etc.). It was also assumed that the clinker was completely burned and equilibrium maintained on cooling. This is by no means correct, but for the purpose desired it was assumed to fit the conditions at hand.

From the data in Tables V, VI, VII, and VIII it will be observed that mixes with a low Alumina Modulus have lower early strengths but have higher later strengths; conversely, mixes with a high alumina modulus have higher early strengths and not only lower later strengths, but in many cases retrogression has taken place.

It is generally the case that the higher the alumina, the greater the heat of hydration; also, the greater the alumina, the greater the contraction.

From a critical examination of the data presented, both from a technical or mathematical viewpoint as well as the physical characteristics from an independent investigation, it will be seen that for an average optimum mix equation (5) expresses the manufacturing conditions from an economical standpoint, thus:

$$CaO = 2.536\ SiO_2 + 1.622\ Al_2O_3 + 0.37\ Fe_2O_3.$$

Cements complying with this equation should not only possess moderate early strengths, low heat of hydration, medium contraction, but should be able to stand up well under conditions of sulphate exposure. Mix "h" very nearly falls within most specifications for sulphate-resistant Portland cements. On the other hand, such cement would with sufficient fineness produce a satisfactory high-early-strength Portland cement, having good high-early strength and a moderate amount of C_2S to aid in main-

TABLE IV.—LIME SATURATION INDEX EQUATION:
$CaO = 2.80\ SiO_2 + 1.18\ Al_2O_3 + 0.65\ Fe_2O_3$

Mix	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV
CaO	69.37	69.55	69.68	69.74	69.81	69.93	70.17	70.30
SiO_2	22.20	22.12	22.06	22.03	22.00	21.94	21.83	21.76
Al_2O_3	3.28	4.16	4.79	5.09	5.46	6.10	7.27	7.94
Fe_2O_3	5.15	4.16	3.47	3.14	2.73	2.03	0.73	0.00
C_3S	84.33	80.48	77.73	76.43	74.82	72.06	67.28	64.49
C_2S	0.00	2.86	4.87	5.82	7.01	9.04	12.48	14.47
C_3A	0.00	4.00	6.84	8.19	9.86	12.72	18.02	21.04
C_4AF	15.67	12.66	10.56	9.56	8.31	6.18	2.22	0.00
C_3S/C_2S	Inf.	28.140	15.961	13.132	10.673	7.971	5.391	4.456
C_4AF/C_3A	Inf.	3.165	1.544	1.167	0.843	0.486	0.122	0.00
A/F	0.638	1.00	1.38	1.622	2.00	3.00	10.00	Inf.
S/A+F	2.634	2.656	2.669	2.676	2.685	2.699	2.728	2.741
S/A	6.768	5.317	4.605	4.328	4.029	3.597	3.003	2.741
S/F	4.311	5.317	6.357	7.016	8.059	10.807	29.904	.....
C/S+A+F	2.265	2.285	2.298	2.305	2.312	2.326	2.352	2.367
C/S	3.125	3.144	3.159	3.166	3.173	3.187	3.214	3.231
C/A	21.149	16.718	14.547	13.701	12.786	11.464	9.652	8.853
C/F	13.470	16.718	20.081	22.210	25.571	34.448	96.120	.....
Heat of Formation	217.6	223.1	226.9	228.8	231.1	235.0	241.9	245.8
% Liquid Formed	21.01	21.42	21.76	21.93	22.12	22.47	23.06	23.42
Burnability Index	10.36	10.42	10.43	10.43	10.44	10.46	10.49	10.50
C_3S	84.33	80.48	77.73	76.87	77.75	79.18	82.18	82.91
C_2S	0.00	2.86	4.87	5.48	4.68	3.36	0.62	0.00
C_3A	0.00	4.00	6.84	7.89	7.91	7.95	8.00	8.04
C_3A_3	.....	.....	.....	0.19	1.35	3.33	6.98	9.05
C_4AF	15.67	12.66	10.56	9.56	8.31	6.18	2.22	0.00
C_3S/C_2S	Inf.	28.140	15.961	14.027	16.613	23.565	132.548	Inf.
$C_4AF/C_3A+C_3A_3$	Inf.	3.165	1.544	1.183	0.897	0.548	0.148	0

TABLE V.—LIME SATURATION INDEX EQUATION:
$CaO = 2.536\ SiO_2 + 1.622\ Al_2O_3 + 0.37\ Fe_2O_3$

	Mix	a	b	c	d	e	f	g	h
	CaO	64.48	64.73	63.59	65.68	63.57	64.84	63.92	64.45
	SiO_2	21.17	21.57	19.81	23.02	19.77	21.74	20.33	21.12
	Al_2O_3	5.17	4.77	6.56	3.28	6.59	4.59	6.03	5.21
	Fe_2O_3	3.18	2.94	4.04	2.02	4.06	2.83	3.72	3.21
	MgO	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
	SO_3	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
	Misc.	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
	C_3S	53.30	54.20	49.68	58.15	49.69	54.72	51.08	53.19
	C_2S	21.48	21.95	20.23	23.18	20.12	22.06	20.69	21.43
	C_3A	8.31	7.67	10.55	5.29	10.59	7.38	9.69	8.39
	C_4AF	9.69	8.95	12.31	6.15	12.37	8.61	11.32	9.77
	A/F	1.622	1.622	1.622	1.622	1.622	1.622	1.622	1.622
	S/A+F	2.536	2.800	1.867	4.337	1.856	2.929	2.085	2.507
	C_3S/C_2S	2.482	2.469	2.455	2.508	2.469	2.480	2.469	2.481
	C_4AF/C_3A	1.165	1.167	1.167	1.163	1.167	1.167	1.169	1.165
	1 Day	490	497	467	521	468	499	475	490
	3 Days	1541	1558	1472	1635	1474	1569	1500	1539
	7 Days	2505	2502	2498	2516	2506	2505	2501	2507
A	28 Days	4141	4108	4245	4000	4250	4095	4207	4146
	3 Mos.	5174	5188	5123	5239	5122	5194	5142	5172
	1 Year	5456	5516	5248	5735	5242	5542	5327	5449
	2 Years	5694	5783	5378	6117	5371	5824	5499	5683
B	28 Days	3761	3695	3978	3468	3985	3669	3896	3769
	1 Year	5184	5150	5298	5030	5301	5136	5255	5188
	1 Day	160	160	164	155	164	159	163	161
	3 Days	297	294	307	284	308	291	304	297
	7 Days	366	363	373	357	373	363	371	367
C	28 Days	447	444	449	442	448	444	448	446
	3 Mos.	458	459	451	462	453	458	454	457
	1 Year	424	428	412	442	412	430	416	425
	2 Years	420	427	402	445	403	429	410	421
	3 Days	73	73	75	72	74	73	73	73
	7 Days	83	82	84	81	84	82	83	82
D	28 Days	93	91	93	90	93	91	92	90
	3 Mos.	98	96	98	97	98	97	96	97
	1 Year	105	106	106	106	106	105	104	104
	% Contraction	0.0827	0.0820	0.0855	0.0791	0.0857	0.0817	0.0845	0.0828

taining later strengths without the dangers of retrogression.

As a result of this investigation it has been shown that the Acid Modulus ($SiO_2/Al_2O_3 + Fe_2O_3$) has a direct relationship to the Burnability Index (Heat of Formation ÷ Percentage of Liquid). It is rather difficult to find any proof from a practical standpoint regarding the previous statement, but it is definitely known that cements with a low Acid Modulus are extremely easily clinkered. In fact, in most instances the trouble lies in the development of clinker rings. This is, of course, also dependent upon such factors, as:

1. Internal diameter of the kiln,
2. Inclination, or slope, of the kiln,
3. Speed at which the kiln is rotated,
4. Rate of firing and type of combustion (with or without preheat),
5. Fineness of the raw material,
6. Physical characteristics of the raw material, such as the mineralogical composition, and
7. Type and grade of refractory.

Of all the previously-mentioned factors pertaining to the development of clinker rings, it is the writer's opinion that the fineness and mineralogical composition of the raw material are the most important. In the past it has been the general policy to increase the fineness of the raw material, at least in so far as the No. 200-mesh sieve was concerned, without much regard to the subsequent effect upon cement quality. To be sure fineness as indicated by this size sieve does form a guide for raw material preparation. However, fineness just for the sake of fineness is of no particular benefit unless it is accompanied by a classification of particle sizes. Other things being equal, a chemical reaction is directly proportional to the fineness of the particles entering into the reaction. Cement manufacture is no exception; in fact, clinker production is a more critical process than generally supposed.

In so far as the kiln is concerned, clinker quality is measured by the amount of "Free Lime." This is influenced, first, by the chemical design of the mix and, second, by the fineness of the raw material. The presence of particles larger than a "critical" size, which may in some cases be the 100-mesh (120 microns) or even the 200-mesh (74 microns), may affect the "Free Lime" in the same proportion. Present grinding methods as represented by the ball- and tube-mill without classifying machinery, either wet or dry, produce a preponderance of superfines (below 10 microns) and at the same time fail to reduce the equally-important large particles (74 microns or greater). In clinker production the superfine particles naturally enter into the reaction with much greater activity than the larger pieces and may in most cases entirely envelop the latter with the result that these large particles do not have any effect save a detrimental influence in the presence of "Free Lime." The mineralogical composition also influences the production of superfines because certain minerals grind and pulverize with much greater ease than others. Thus we would expect silicates of alumina to grind more rapidly than quartz or calcite crystals.

Undoubtedly the most uneconomical combination of raw materials is a mix-

TABLE VI.—LIME SATURATION INDEX EQUATION:
$CaO = 2.536\ SiO_2 + 1.65\ Al_2O_3 + 0.35\ Fe_2O_3$

Mix		I	II	III	IV	V	VI	VII	VIII
CaO		63.50	63.99	64.32	64.48	64.67	64.97	65.54	65.84
SiO_2		21.53	21.33	21.18	21.11	21.03	20.88	20.62	20.48
Al_2O_3		3.49	4.34	4.93	5.20	5.54	6.11	7.12	7.67
Fe_2O_3		5.47	4.34	3.57	3.21	2.76	2.04	0.71	0.00
MgO		3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
SO_3		1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
Misc.		1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
C_3S		54.58	54.07	53.70	53.53	53.31	52.95	52.29	51.93
C_2S		21.54	21.34	21.20	21.12	21.04	20.90	20.64	20.49
C_3A		0.00	4.16	7.02	8.36	10.00	12.74	17.67	20.33
C_4AF		16.65	13.21	10.86	9.77	8.41	6.18	2.17	0.00
A/F		0.638	1.00	1.38	1.622	2.00	3.00	10.00	Inf.
S/A+F		2.403	2.456	2.492	2.509	2.531	2.565	2.633	2.669
C_3S/C_2S		2.536	2.533	2.533	2.534	2.534	2.534	2.533	2.534
C_4AF/C_3A		Inf.	3.179	1.547	1.169	0.841	0.485	0.123	0.00
A	1 Day	362	427	470	491	517	560	636	677
	3 Days	1308	1430	1511	1549	1597	1674	1815	1890
	7 Days	2070	2294	2448	2519	2607	2754	3018	3160
	28 Days	3588	3870	4063	4153	4264	4448	4782	4960
	3 Mos.	5056	5113	5151	5170	5190	5228	5294	5329
	1 Year	5769	5609	5497	5444	5380	5272	5081	4974
	2 Years	6083	5884	5747	5682	5602	5471	5232	5101
B	28 Days	3053	3412	3661	3778	3919	4157	4584	4815
	1 Year	4795	4993	5128	5190	5267	5398	5630	5756
C	1 Day	128	144	155	160	167	178	198	209
	3 Days	275	287	294	299	303	311	324	331
	7 Days	337	353	363	366	372	383	401	410
	28 Days	422	434	443	446	452	459	473	482
	3 Mos.	455	455	455	457	457	457	459	458
	1 Year	432	429	426	424	423	421	416	413
	2 Years	435	428	422	420	417	411	403	397
D	3 Days	62	68	72	73	75	80	86	89
	7 Days	71	77	81	83	86	89	96	99
	28 Days	79	85	89	92	94	98	106	109
	3 Mos.	87	92	96	98	100	103	109	113
	1 Year	92	99	103	106	109	112	120	124
% Contraction		0.0604	0.0366	0.0804	0.0830	0.0858	0.0907	0.1090	0.1144

TABLE VII.—LIME SATURATION INDEX EQUATION:
$CaO = 2.536\ SiO_2 + B\ (Al_2O_3 - 0.638\ Fe_2O_3) + 1.40\ Fe_2O_3$

Mix		IX	X	XI	XII	XIII	XIV	XV	XVI
CaO		63.50	63.99	64.32	64.45	64.46	64.48	64.52	64.55
SiO_2		21.53	21.33	21.18	21.12	21.11	21.11	21.10	21.08
Al_2O_3		3.49	4.34	4.93	5.21	5.61	6.31	7.63	8.38
Fe_2O_3		5.47	4.34	3.57	3.21	2.81	2.11	0.76	0.00
MgO		3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
SO_3		1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
Misc.		1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
C_3S		54.58	54.07	53.70	53.19	50.98	47.23	40.17	36.38
C_2S		21.54	21.34	21.20	21.43	23.11	25.98	31.36	34.20
C_3A		0.00	4.16	7.02	8.39	10.13	13.15	18.93	22.20
C_4AF		16.65	13.21	10.86	9.77	8.55	6.41	2.32	0.00
A/F		0.638	1.00	1.38	1.622	2.00	3.00	10.00	Inf.
S/A+F		2.403	2.456	2.492	2.507	2.507	2.510	2.514	2.517
C_3S/C_2S		2.536	2.533	2.533	2.481	2.206	1.818	1.281	1.064
C_4AF/C_3A		Inf.	3.179	1.547	1.165	0.844	0.487	0.122	0
A	1 Day	362	427	470	490	498	516	549	570
	3 Days	1308	1430	1511	1587	1532	1519	1501	1494
	7 Days	2070	2294	2448	2507	2511	2526	2553	2577
	28 Days	3588	3870	4063	4146	4206	4314	4525	4650
	3 Mos.	5056	5113	5151	5172	5204	5261	5370	5429
	1 Year	5769	5609	5497	5449	5409	5341	5209	5128
	2 Years	6083	5884	5747	5683	5610	5485	5244	5105
B	28 Days	3053	3412	3661	3769	3859	4017	4325	4505
	1 Year	4795	4993	5128	5188	5248	5353	5556	5673
C	1 Day	128	144	155	161	164	170	181	188
	3 Days	275	287	294	297	298	298	298	298
	7 Days	337	353	363	367	367	367	368	369
	28 Days	422	434	443	446	449	454	463	470
	3 Mos.	455	455	455	457	460	464	472	478
	1 Year	432	429	426	425	426	428	432	433
	2 Years	435	428	422	421	419	415	410	407
D	3 Days	62	68	72	73	75	75	78	80
	7 Days	71	77	81	82	83	84	86	88
	28 Days	79	85	89	90	92	95	99	101
	3 Mos.	87	92	96	97	98	100	103	105
	1 Year	92	99	103	104	105	109	112	114
% Contraction		0.0604	0.0666	0.0804	0.0821	0.0860	0.0912	0.1002	0.1069

ture of limestone and clay. In this case the clay is very finely divided and for the most part is composed of silicates of alumina. On the other hand, the limestone is generally of a hard variety and composed of quartz, feldspar, and calcite crystals, with additional small amounts of mica. In grinding these two materials together in a ball- or tube-mill the fineness is invariably regulated by the No. 200-mesh sieve. In this event the clay merely becomes more finely divided, while the limestone is only moderately reduced in particle size. As a result the kiln feed contains many large inert particles surrounded by an almost infinite amount of minute pieces, with a consequent effect upon the quality as well as on the economical production of the cement. Practically all plants using a mixture of limestone and clay report a large coal consumption (120 to 150 lb. of coal per bbl., depending upon the process) in the kiln and a moderate amount of "Free Lime."

On the other hand, the best type of raw material is a mixture of high- and low-lime cement rock. In this case all the raw materials have the same general mineralogical composition and when ground are graded uniformly without too great an amount of superfines and the minimum amount of particles greater than the "critical size." Thus it is found that such plants burn with a low fuel consumption (70 to 100 lb. of coal per bbl., depending upon the process) and the minimum amount of "Free Lime."

Modern practice seems to favor the utilization of classifying equipment such as air-separators in the dry process and wet classifiers in the wet process. The results of the improvements are by no means complete, but there is definite indication that the progress is in the proper direction.

Conclusion.—As a result of this investigation it might be concluded that in the design of any mix the first consideration is the Alumina Modulus ($Al_2O_3 \div Fe_2O_3$), the second consideration is the Acid Modulus ($SiO_2 \div Al_2O_3 + Fe_2O_3$), and the third consideration is the Lime-Saturation Index Equation. Although the Al_2O_3 and Fe_2O_3 are not equal in weight molecularly, it has been shown that the two are interrelated to the extent that each one can not be considered independently since there are two limits. The upper limit is not very well defined, but from a practical standpoint it might be stated that the Alumina Modulus should not be greater than 2.45. On the other hand, the lower limit is definitely equal to the molecular ratio, or about 0.638.

Similarly, the Acid Modulus has been shown to represent maximum and minimum limits, when:

$$\frac{CaO}{SiO_2 + Al_2O_3 + Fe_2O_3} = \frac{SiO_2}{Al_2O_3 + Fe_2O_3} \quad \text{(Minimum Limit)}$$

and

$$\frac{CaO}{SiO_2} = \frac{SiO_2}{Al_2O_3 + Fe_2O_3} \quad \text{(Maximum Limit)}$$

The optimum condition would, therefore, be expressed as the mean between the maximum and minimum limits.

(*Continued on page 81*)

TABLE VIII.—LIME SATURATION INDEX EQUATION:
$CaO = 2.80\ SiO_2 + 1.18\ Al_2O_3 + 0.65\ Fe_2O_3$

Mix		XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV
CaO		65.58	65.75	65.87	65.93	65.99	66.09	66.33	66.45
SiO_2		20.59	20.52	20.47	20.44	20.41	20.35	20.25	20.19
Al_2O_3		3.04	3.86	4.44	4.72	5.07	5.66	6.74	7.36
Fe_2O_3		4.78	3.86	3.22	2.91	2.53	1.88	0.68	0.00
MgO		3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
SO_3		1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
Misc.		1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
C_3S		78.23	74.66	72.11	70.90	69.41	66.85	62.42	59.83
C_2S		0.00	2.65	4.52	5.40	6.50	8.38	11.58	13.42
C_3A		0.00	3.71	6.35	7.60	9.15	11.80	16.72	19.52
C_4AF		14.54	11.74	9.80	8.87	7.71	5.73	2.06	0.00
A/F		0.638	1.00	1.38	1.622	2.00	3.00	10.00	Inf.
S/A+F		2.634	2.656	2.669	2.676	2.685	2.699	2.728	2.741
C_3S/C_2S		Inf.	28.140	15.961	13.132	10.673	7.971	5.391	4.456
C_4AF/C_3A		Inf.	3.165	1.544	1.167	0.843	0.486	0.122	0.00
A	1 Day	570	599	621	633	645	667	710	734
	3 Days	2002	2017	2028	2033	2040	2051	2080	2084
	7 Days	3126	3187	3230	3250	3275	3319	3414	3465
	28 Days	4266	4427	4543	4597	4664	4779	5004	5130
	3 Mos.	4914	5001	5048	5070	5097	5144	5230	5278
	1 Year	5391	5314	5244	5210	5170	5099	4967	4888
	2 Years	5926	5769	5658	5603	5537	5423	5212	5087
B	28 Days	3789	4013	4173	4249	4343	4505	4813	4988
	1 Year	5065	5203	5306	5352	5411	5510	5701	5808
C	1 Day	170	180	185	190	193	199	212	220
	3 Days	336	337	340	341	342	342	347	349
	7 Days	411	413	417	418	419	423	428	431
	28 Days	449	456	462	465	468	473	483	489
	3 Mos.	426	430	434	434	437	440	446	449
	1 Year	398	399	399	400	402	402	401	402
	2 Years	415	411	409	407	405	403	397	393
D	3 Days	81	83	86	86	87	90	92	94
	7 Days	92	95	96	97	98	101	103	105
	28 Days	96	99	102	102	104	107	111	113
	3 Mos.	101	105	107	107	110	112	114	118
	1 Year	110	115	117	117	119	122	126	128
% Contraction		0.0689	0.0754	0.0800	0.0823	0.0850	0.0897	0.0983	0.1033

TABLE IX.—COEFFICIENT OF LINEAR EQUATIONS AT AGE INDICATED

Compound	1 Day	3 Days	7 Days	28 Days	3 Mos.	1 Year	2 Years
28 Days in Moist Room, then in Water							
2-in. Plastic-Mortar Cubes 1:2.75 Mix by Weight							
C_3S	8.5	27.4	40.0	48.8	55.7	61.8	70.7
C_2S	0.3	−1.1	−5.1	19.1	62.9	80.6	82.2
C_3A	11.3	24.1	58.4	100.1	56.4	5.6	−12.5
C_4AF	−6.5	−9.8	−0.2	30.8	39.7	39.6	27.2
3 by 6-in. Concrete Cylinders 1:2.4:3.6 Mix by Weight							
C_3S				41.4		54.8	
C_2S				7.6		42.4	
C_3A				123.4		100.4	
C_4AF				37.8		53.5	
1:3 Standard Ottawa Sand Briquets							
C_3S	2.1	3.6	4.6	5.0	4.7	4.6	4.9
C_2S	0.3	0.8	1.3	3.8	6.1	6.4	6.1
C_3A	4.6	6.3	7.1	7.1	4.4	2.1	0.9
C_4AF	0.4	3.7	3.5	4.0	4.0	2.6	2.2

Note: The original data contained limits of probable errors, but these have been dropped in this investigation for convenience of comparison.

"It should be understood that this and similar computations apply strictly only to the conditions involved in the series from which the equations were obtained. Applications to other ranges of composition, conditions of manufacture, and conditions of test, amount to extrapolation, and are subject to the errors often encountered when extrapolation is attempted." (5)

TABLE X.—HEAT OF HYDRATION+
(Cals. per gm.)

Compound	3 Days	7 Days	28 Days	3 Mo.	1 Year
C_3S	98	110	114	122	136
C_2S	19	18	44	55	62
C_3A	170	188	202	188	200
C_4AF	29	43	48	47	30

TABLE XI.—COEFFICIENTS OF LINEAR EQUATIONS REPRESENTING RELATION BETWEEN COMPOSITION AND TOTAL CONTRACTION OF MORTAR BARS (per cent.)

Compound	After 7 Days Moist Curing Total Age 12 Months
C_3S	0.00079
C_2S	0.00077
C_3A	0.00234
C_4AF	0.00049

One of the five 6-cu.yd. side-dump quarry trucks being loaded by the 1¾-cu.yd. electric shovel.

Illinois Quarry Abandons Rail Haulage, Adopts Motor Trucks

ABOUT 8 mi. southeast of East St. Louis, Ill., in Centerville Township, St. Clair County, is located one of the largest and most modern crushed-stone plants in the St. Louis area.

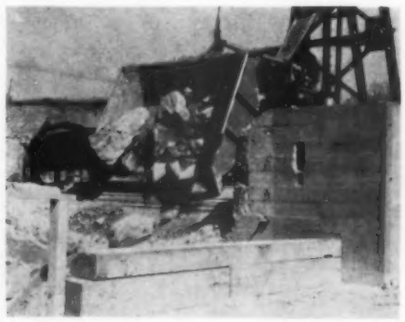
This plant and its deposit have an interesting history. The quarry was originally opened in 1854 for the production of rubble and the original plant was built in 1899 by the East St. Louis Stone Co., which was headed then, as it is now, by R. E. McLean. Operations were carried on by this company until June 1, 1927, when the property was leased to the Illinois Electric Lime stone Co., a subsidiary of a New York strip coal-mining syndicate. This company built an entirely new plant of 250-ton per hr. capacity, (P & Q, January 16, 1929, pp. 65-70) which went into operation early in 1928. In August, 1931 this company went into receivership and the plant was operated by the receivers until September, 1932. At that time plant operation was discontinued. On December 1, 1932 the East St. Louis Stone Co., owner of the property, took over the plant. On February 1, 1933 another new corporation, the Electric Limestone Co., leased the property and plant and operated them until February 15, 1934. At that time, they were again taken over by the East St. Louis Stone Co., which, after making a number of improvements, again started to operate the property in May, 1934, after a lapse of nearly seven years. Since that time many improvements were made and equipment was installed for more efficient and economical operation. Early in 1935 a 4-ft. by 10-ft. triple deck Symons screen was installed. This removes material over 2 in. in size ahead of the three main sizing screens. The bottom deck has a dust screen and the middle deck protects this from the stone. Otherwise the plan is substantially the same as when it was previously described.

The major improvements made have been outside the plant, particularly in removing overburden and loading and hauling rock from the quarry. In January, 1936 the railway system of haulage in the quarry was replaced by two Hug 87Q trucks with 6-cu.yd. Easton Phoenix side-dump bodies. A few months later a third Hug Type 87Q truck was added in the quarry and two Hug Type 87-M trucks were purchased to replace the railway system used to haul away the overburden. The latter two trucks have 4-cu.yd. rear dump bodies with St. Paul hydraulic hoists. In September, 1936 two more Hug Type 87Q trucks were added in the quarry and a new Marion 490 electric shovel was put into service. This shovel supplements another Marion 490 shovel purchased in 1930 by the Illinois Electric Limestone Co. Both shovels have 2¼-cu.yd. dippers and Ward-Leonard controls.

The five Hug Type 87Q quarry trucks are equipped with 6-cyl. Buda K-428 engines, have five forward speeds with 2-speed auxiliary transmissions, double-reduction rear axles, and dual rear wheels. Two of these trucks have 10.50-in. by 20-in. Goodrich Silvertown heavy-duty Excavator tires. The other three quarry trucks have 10.50-in. by 20-in. Firestone heavy-duty High-Speed non-skid balloon tires. The two stripping trucks also have dual rear wheels and are equipped with 9.75-in. by 20-in. Firestone Ground Grip tires. Each truck has a reinforced-steel hood attached to the body to protect the driver from the shovel dipper and the stone or other material being loaded. This makes it unnecessary for the driver to leave his seat while the truck is being loaded and helps to speed up operations.

The overburden on this deposit averages about 20 ft. in depth. Formerly two 14-ton gasoline locomotives were used, each hauling four 4-cu.yd. cars. Loading was done with a Marion 37 electric shovel with a 1¾-cu.yd. dipper. The length of haul averaged about 750 ft. With this system a crew of 10 men in addition to the shovel crew was required. Two men operated the locomotives, 2 kept the track in shape and 6 were on the over-burden dump. Now a larger quantity of materials, about 750 cu.yd. in a 9-hr. day is handled by the two Hug

Truck in position for dumping to primary crusher with dumper hook attached.



Truck body in full dumping position. Note how dumper arm has followed body arc.

4-cu.yd. trucks supplemented by two hired trucks. An Allis-Chalmers WK tractor with a Baker bulldozer keeps the dump in shape. The same Marion 37 shovel does the loading and its crew remains the same. The present crew consists of only 6 men, 4 on the trucks, 1 on the tractor and 1 for general work.

The 1¾-cu.yd. electric shovel loading one of the quarry trucks.

According to Mr. McLean, the overburden is being handled at a saving of 2c. per cu.yd. as compared with the former system and there are other advantages which can not be evaluated. Elimination of the delays due to moving the track and to wash-outs caused by heavy rains is another important factor. When no stripping is being done, these trucks are used for a number of purposes about the plant, such as stock-piling excess material, reclaiming from stock-piles, helping out in the quarry, etc.

One of the two 4-cu.yd. trucks ordinarily used for overburden rehandling materials from stock-piles.

Because of the short time that the entire fleet of five 6-cu.yd. quarry trucks has been in use, Mr. McLean has no accurate figures to show the comparative cost of handling by locomotives and by trucks, but is convinced that the trucks are more economical. In addition, the use of trucks has reduced quarry delays and has resulted in better control of the feed to the plant. Tracks formerly had to be moved after each cut along the face and before each blast. This nuisance is eliminated by the use of trucks and the shovels can now be moved about the quarry as desired to get different types of stone, to move away from mud seams and to avoid tight bottoms or large rocks which require secondary shooting. Sometimes in a day's operation a shovel may work from one end of the face to the other end.

Another view of one of the 6-cu.yd. quarry trucks being loaded.

The average haul to the primary crusher is about 500 ft., and the five trucks easily supply enough material to keep the plant operating at its capacity of 250 tons per hr. The quarry has a 1,100-ft. face averaging about 55-ft. in height and the floor is on the same level as the plant. Bottom shots are now being made to lower the quarry floor 15 ft., and this level will be developed to the present quarry area.

Cars were formerly dumped into the Kennedy-Van Saun No. 36 gearless gyratory primary crusher by a rotary car-dumper. A 30-ton hand-operated hoist supported on a steel frame and I-beams served the dumper and the crusher. Trucks are now dumped by means of an Easton Car & Const. Co. patented air-dump mounted on one of the steel standards of the hoist frame. This truck-dumper is of the arm-and-elbow type and is operated by a Curtis air-cylinder, which is connected to a cable that runs vertically to the top of the frame and over a pulley, then horizontally to a pulley directly over the point where the trucks are dumped. The end of the cable is attached to a hook at what might be called the wrist of the dumper. This hook, when raised, automatically engages a horizontal bar attached to one side of the truck body and dumps the load by a direct lift. The use of three flexible joints in the dumper allows it to follow the truck body through the dumping arc and back to its original position, where the hook automatically disengages from the truck body and is ready for the next load.

Dumper hook in position for engaging truck body. Air cylinder is at right.

Coarse-Aggregate Sizes Accepted as Standard

With a few minor changes the tentative sizes of coarse aggregates (crushed stone, gravel and slag) recommended more than a year ago by the joint Technical Committee of the mineral-aggregates associations—the National Crushed Stone Assn., the National Sand & Gravel Assn. and the National Slag Assn.—were approved by the National Bureau of Standards of the U. S. Dept. of Commerce on June 10. They have just been issued as Simplified Practice Recommendation R 163-36.

The complete tables appeared on pp. 39 and 40 of Pit and Quarry for December, 1935, and the reader is referred to that issue for complete data. The following changes should be noticed:

Group A Sizes of Coarse Aggregates.—The acceptable amounts finer than each square-opening sieve size, expressed in percentages by weight, for the G 1 material have been changed from 75-100 to 80-100 for the 1-in., from 25-35 to 20-40 for the No. 4, and from 0-4 to 15-35 for the No. 8. New ranges of 5-25, 0-10, and 0-2 have been adopted for No. 16, No. 50 and No. 100, respectively.

The figures for the G 2 material have been changed from 5-25 to 10-35 for the No. 4 and from 0-4 to 0-10 for the No. 8. A new range of 0-5 has been adopted for No. 16. The G 3 material percentages have been changed from 0-3 to 0-15 for the No. 4 and a new percentage range of 0-5 has been adopted for the No. 8.

Group B Sizes of Coarse Aggregates.—The 1 B material carries the same percentage range as originally proposed for the 3½-in., namely 90-100, but a footnote, "100 per cent. finer than 4 in.," has been added.

The G 1 material percentage ranges have been changed from 75-100 to 80-100 for the 1-in., from 25-35 to 20-40 for the No. 4, and from 0-4 to 15-35 for the No. 8.

Damaged Cast-Iron Crusher Head Replaced With Welded Plates

WHEN the cast-iron head on a No. 8 gyratory crusher became damaged and unfit for further service at the plant of the Lincoln Crushed Stone Co. at Joliet, Ill., recently, arc-welding and cutting were resorted to in order to place the machine back in service in the shortest possible time and at the minimum cost consistent with the utmost satisfaction in the repair job.

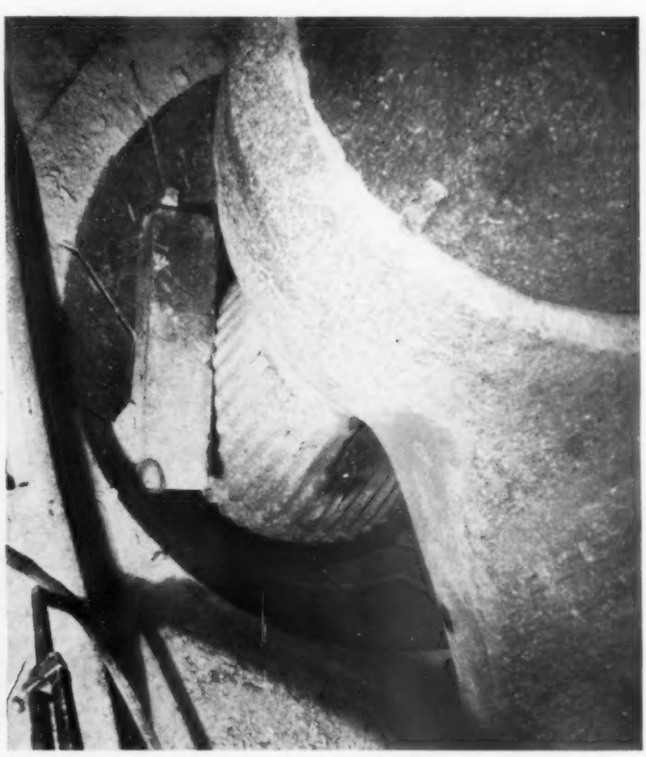
The entire repair was made in place without dismantling the crusher and the entire job completed in a remarkably short time.

The chilled cast-iron head was 40 in. high and approximately 23½ in. in diameter at the top and 39½ in. at the bottom. To remove the casting from the shaft it was cut in three sections, using the electric arc with Hollup "B" rod, the cuts extending from the shaft to the edge of the casting and along the entire 40-in. height of the head.

Welders and others interested in the work grouped about a section of the cast-iron head cut out with the metallic arc.

After the casting had been removed from the shaft, a new crusher head was formed by welding in place and to the shaft a series of circular plates 4 in. thick. The plates were prepared by a Hobart flame-cutting machine, the outer edges being beveled at the correct angle and slotted to receive the shaft. With the plate in position, the piece cut out to form the slot was inserted and welded into place, forming a complete disk. The completed crusher head consisted of ten of these disks welded together in laminated form.

Electric-arc cutting in progress. Three grooves were cut from top to bottom. Care was taken to avoid cutting into the steel shaft.



The damaged cast-iron crusher head. The dark mark in the corrugated surface shows the start of the cut with the electric arc.

Flame-cut laminations in place on the shaft. Each circular plate was cut and fitted about the shaft, the cut-out section welded into the plate and another plate placed above it completely built up.

The completed built-up laminated head. After welding the plates together the outside was entirely coated with hard-surfacing material, purposely left roughened to improve the crushing action.

In assembling the plates, the largest was first placed in position at the bottom and leveled and trued up before being welded into place. The cut-out piece was then inserted in place and was welded to the edges of the disk on each side. The second plate was then placed on the first and welded to the first plate along the edges of the slot, and the slot piece then inserted and also welded in place. This method was continued until all ten plates were assembled and welded. Each plate was placed on the one below in such a position that the center line of the slot made an angle of about 60 deg. with the slot in the plate immediately beneath. Thus the plates were moved 1½ times around the shaft in arranging them. Each plate was firmly keyed to the shaft in such a manner that it would be impossible for it to work loose. After the assembly of the crusher head, the lower half of it was coated with Stoody hard-facing material.

The entire job was planned carefully so that the crusher was out of use for only one week. There was no additional cost to the Lincoln company for dismantling the machine, nor any interference with other operations. All other departments of the plant were free to operate while the repair work was going on.

There are said to be several advantages to this process of dismantling and assembling the crusher head. In the first place, it minimizes the interference with the operation of the plant, since neither the shaft nor any other part of the crusher has to be removed. Second, the new head, being fabricated of alloy-steel plate, is indestructible and will last indefinitely. The hard wearing surface can be replaced repeatedly as needed at nominal cost. Should a dipper tooth or tramp iron get into the crusher, the most it could do would be to dent the head, and such damage could be easily repaired by arc-welding.

The new crusher head is said to be giving unusual satisfaction. A more uniform product is being obtained than formerly, and output has been increased.

This new method of crusher-head construction was developed by the Equipment Reclamation Works, Chicago, Ill., who have applied for a patent on the method. The work was carried out under the personal supervision of A. R. Gay, W. A. Owens and J. W. Clayton. (Illustrated by courtesy of *The Welding Engineer.*)

Diatomite Deposits Are Found in New Brunswick

Investigation of diatomite deposits in New Brunswick Province, for the Provincial Inspector of Mines, shows considerable promise for future development.

A good deposit of partly white but mainly yellowish diatomite, 3 to 5 ft. deep and extending about 7 acres was found at Stannard Lake, 3 miles south of Albert mines, Albert County. A good-grade deposit containing 2 to 8 ft. of dark-brown diatomite, although in some places dense white, in area about 10 acres, was found 16 miles southeast of Sussex, at Flood Lake, Kings County. A shallow deposit on a 5-acre lake was found at Mechanic Settlement, McNair Lake.

A deposit 1 mile south of Mechanic Settlement and 12 miles south of Penobsquis Station, Pollet Lake has been known for a number of years and worked to a certain extent. This deposit, said to be one of the best diatomite deposits in the Province, is 2 to 5 ft. in thickness and 70 acres in extent. The lake is shallow and could easily be drained.

A deposit of gray diatomite 4 to 9 ft. thick, extending over about 70 acres of what was originally a lake but was drained 40 years ago, is situated 8 miles east of Saint John, Fitzgerald Lake, Saint John County.

In Charlotte County there is a deposit about 4 miles northwest of St. George and two other locations near MacDougall Lake, about 10 miles northeast of St. George; and also at Little River Lake, north of Pocologan Station on the Shore Line.

By PIT AND QUARRY'S
WASHINGTON OBSERVER
AND CORRESPONDENT

Probable Effect and Scope of Legislation Pending in Congress

OF ALL the legislation pending in Washington Senator O'Mahoney's bill has probably impressed representatives of industry and trade with most emphasis. It is curious that this should be so, because the Senator's proposals ordinarily would be labelled drastic and radical and would be passed over as the proposal of an extremist.

But it is interesting to observe that every conservative and every representative of industry who comes under the influence of the Senator's persuasive and utterly sincere personality is thoroughly impressed with the fact that he is not essentially an extremist and that he is thoroughly reasonable. Almost invariably those who might be expected to be most violently opposed to his ideas are won over to at least a serious and respectful consideration of his bill.

By the time this is published there will undoubtedly have been much discussion of his suggestions which have been brought out in the hearing of the Judicial Committee of the Senate. There is nothing unique in the senator's broad outline of the legislation he proposes, but the peculiar force of patient, honest sincerity he brings to its advocacy makes his bill one of the most serious probabilities that confront industry and trade in the way of legislation. Executive Secretary V. P. Ahearn of the National Sand & Gravel Assn. has declared that "the prospects for legislative success of the O'Mahoney bill will be enhanced if the Supreme Court should invalidate the National Labor Relations Act or the unemployment-compensation insurance provisions of the Social Security Act."

The O'Mahoney bill, in a sense, is an epitomization of many of the bills that have been introduced in this session of Congress for the regulation of industry. The bill provides that persons and corporations shall be licensed by the Federal Trade Commission, and that the license shall prohibit child labor, prohibit discrimination against female employees, vest in employees the right of self-organization, and it sets up a general rule for determining the rates of pay, hours of work and other conditions of employment. Federal incorporation would supplant the present system of state corporation charters, and a Bureau of Corporations would issue charters for corporations.

Senator O'Mahoney holds that Congress apparently does not fully comprehend and clearly define its constitutional power to regulate commerce. He believes Congress should have, and has, the power to assume the same full jurisdiction over commerce that it has over money.

It is possible that the Supreme Court will have ruled upon the National Labor Relations Act—the so-called Wagner bill—by the time this is published. Only the Supreme Court knows when these decisions will be uttered. It is possible that clarification of the whole prospective national economic policy will depend upon this decision. The word around Washington has been that the leaders of the various strikes in progress have been sparring for time until this ruling will have been published.

There is one point on which all commentators in Washington agree and that is that this session of Congress will enact some notable form of industrial-control legislation. Again quoting Mr. Ahearn, it is interesting that he is "inclined to view with a skeptical eye any suggestion that the political temper is such that industry occupies a favorable position with reference to securing helpful amendments of the anti-trust laws." The President has insistently reiterated that long hours, low wages and child labor must be eliminated. Senator Robinson has repeatedly proclaimed that this session of Congress must enact a 30-hr. week for labor following the American Federation of Labor program for a 6-hr. day and a 5-day week. Several bills have been introduced. It is generally believed that the amendments to the Walsh-Healy Act, devised by the Secretary of Labor, will impose the 30-hr. week and in some instances an increase in wages. This means, if this assumption is correct, that the 8-hr. day and the 40-hr. week now obligatory on government-contract work will be altered to meet the demand of the A. F. of L. The amendments also provide that Federal contracts subject to the act be reduced from $10,000 to $2,000, and that the law be extended to include subcontractors, provide for collective bargaining and prohibit home work.

Up to the time this is written 15 complaints involving 46 respondents have been filed under the Robinson-Patman Act. Congress Patman has introduced a bill prohibiting manufacturers and wholesalers from engaging in retail business, and likewise prohibiting retailers from engaging in the manufacturing or wholesaling business. Legislation widely enlarging the inquisitorial powers of the Federal Trade Commission and giving it authority to initiate prosecutions without specific complaint—a sort of commercial *lettre de cachet,* as it were—is also to be considered. The whole tendency of the Federal Trade Commission at present is to assert authority over all commerce, intrastate as well as interstate, when it can set up any legal basis to do so. On the other hand the attorney-general has ruled that the Robinson-Patman Act does not apply to government work.

Senator Borah has introduced a bill for a licensing system similar to the O'Mahoney Bill, but much less specific and apparently vulnerable. The bill

drafted by Major Berry's Council for Industrial Progress and providing regulation of hours, wages, trade practices, more anti-trust administration, and loans to small industries, somewhat like the Home Owners' Loan Corporation program, also has been introduced. There are many bills setting up systems of control of wages, hours, and trade practices, designed to produce some form of N.R.A. However, it seems probable that Mr. Ahearn's opinion is accurate when he says, "no successful effort will be made to reënact the National Industry Recovery Act, meaning by that a law patterned closely after the invalidated statute."

It is quite true, also, that this does not preclude the adoption of some legislation creating something that will have in it the essence of the N.R.A., minus the mistakes which the President acknowledged in his first address to Congress. Such a result will probably come after the quiet campaign now being conducted by Donald R. Richberg, who, in company with Assistant Secretary of Commerce Ernest R. Draper, met recently at dinner in Washington with a group of executive representatives of industrial and trade organizations to discuss means of clarifying the confused and impracticable laws regulating business. It was carefully emphasized that nothing said or done would commit the administration. Richberg suggested a restatement of the laws dealing with unfair trade practices to secure a clear expression of national economic policy covering competition, maximum hours, minimum wages and child labor; also the authorization of an agency, like the Federal Trade Commission, to enforce the laws judicially, and the authorization of another agency administratively to apply the law to organize coöperative trade agreements. The program has been submitted widely by letter to industry, trade and finance by the Washington representatives of interested associations, who look hopefully to this movement, expecting that it may, with the tacit approval of the Administration, bring order out of the present confusion. But their principals seem to be very wary, and are as reluctant to make commitments as is the administration.

One striking fact impresses observers in Washington. Agriculture is tightly and strongly organized and works closely with the Department of Agriculture, which is one of the outstanding branches of Government. Labor is strongly represented and organized and works closely with the department devoted to its interests which also is well administered. But there is no such organization and coöperation on the part of industry.

AUTOMATIC WEIGHING EQUIPMENT PROVES SURPRISINGLY ACCURATE

The quarry and crushing plant of the Michigan Limestone & Chemical Co. at Rogers City, Mich., is one of the largest in the world, having a capacity of 12,500,000 tons annually. Automatic machinery plays an important part in handling this huge output and the weighing and recording of production and shipments is no exception. Sixteen Merrick Weightometers have for the past fifteen years performed this function and the accuracy with which this is accomplished is surprising. For example, on boat shipments into Chicago of 201, 650 tons of stone which were reloaded into cars for rail shipment, a check by the Western Weighing & Inspection Bureau revealed an error of only four-tenths per cent.—or an accuracy of 99.6 per cent. On a recent shipment to Buffalo of 76,662 tons, reweighing showed this to be 99.1 per cent. correct, while a total of 967,680 net tons reweighed by the Pennsylvania, the B. & O., and the Erie railroads showed an accuracy of 99.98 per cent.

The Weightometers which record the tonnage loaded into the boats are duplex, or two independent machines. Each beam and integrator weighs one-half the total load. One therefore, is constantly checking against the other and any variation is instantly discernible.

Single Weightometers are used to record the quarry production and output from the crushers.

Readings on the production units are taken every 8 hours to ascertain quarry production. The Weightometers which record the amount of stone going into storage are read every 16 hours to compute the amount of finished material on hand. The duplex units which record the tonnage being loaded into the boats are read hourly until a cargo is loaded. The total tonnage is then placed on the bill of lading, along with the draft to which the vessel was loaded.

Weightometers are also employed at the plant power-house to record the coal consumed and to compute the amount of coal conveyed into the boats.

Shipman (from page 78)

It has also been shown that from a theoretical, economical, and practical viewpoint the optimum mix or "best" Portland cement should approximate the Lime-Saturation Index Equation:

$$CaO = 2.536\ SiO_2 + 1.622\ Al_2O_3 + 0.37\ Fe_2O_3$$
$$Al_2O_3 \div Fe_2O_3 = 1.622$$
$$SiO_2 \div (Al_2O_3 + Fe_2O_3) = 2.507$$

	Theoretical	Practical
CaO	68.15	64 45
SiO_2	22.77	21.12
Al_2O_3	5.62	5.21
Fe_2O_3	3.46	3.21
MgO	.....	3.00
SO_3	.....	1.75
Misc.	.....	1.25

Also it has been shown that the maximum limit in terms of Lime Saturation should approximate the equation:

$$CaO = 2.80\ SiO_2 + B\ (Al_2O_3 - 0.638\ Fe_2O_3) + 1.40\ Fe_2O_3$$

where $B = \dfrac{1.176\ (K - 0.28)}{K - 0.649}$

and $K = Al_2O_3 \div Fe_2O_3$

This equation applies to an Alumina Modulus from 1.566 to Inf., while from 0.638 to 1.566 the equation as developed by Messrs. Lea and Parker must be used:

$$CaO = 2.80\ SiO_2 + 1.18\ Al_2O_3 + 0.65\ Fe_2O_3$$

BIBLIOGRAPHY

1. F. M. Lea and T. W. Parker. *The Quaternary System CaO-Al_2O_3-SiO_2-Fe_2O_3 in Relation to Cement Technology.* Building Research Tech. Paper, No. 16 (1935):

2. John Shipman. *The Lime Saturation Index of Portland Cement,"* PIT AND QUARRY, July, 1936.

3. T. Thorvaldson, W. G. Brown, and C. R. Peaker, *Jour. Amer. Chem. Soc.,* 52, 3927 (1930).

4. R. H. Bogue, Ind. Eng. Chem. Anal. Ed., 1 (4), (1929).

5. H. F. Gonnerman. "Study of Cement Composition in Relation to Strength, Length Changes, Resistance to Sulphate Waters and to Freezing and Thawing, of Mortars and Concrete," A.S.T.M., vol. 34, part II, 1934.

6. F. M. Lea and C. H. Desch. *The Chemistry of Cement and Concrete,* Edward Arnold & Co.

Fluorspar in Germany

The United States continues to be the largest export outlet for German fluorspar, taking 9,095 tons in 1935, according to the U. S. Bureau of Mines. Czechoslovakia took 5,582 tons, Poland 4,138 tons, Austria 3,576 tons, and Sweden 3,126 tons. Germany's 1935 total exports were 31,425 tons, almost the same as the 1934 total of 31,756 tons, but an increase over the 1933 exports of 24,907 tons.

Germany's fluorspar production comes from 26 mines and employs 708 persons. The output increased from 40,800 tons in 1933 to 56,200 tons in 1934, and 93,000 tons in 1935.

Personal Mention

H. J. McDargh, district engineer for the Portland Cement Assn. at Indianapolis, has been appointed regional manager at Atlanta to succeed H. R. Albion, resigned. Mr. McDargh has served successively as fieldman at Indianapolis, office engineer at Columbus, assistant to regional manager Carl Franks at Chicago and district engineer at Indianapolis. While among the youngest of the associations engineers, Mr. McDargh has just completed his twelfth year of service.

Wm. J. Reardon of the Reardon Cement Co., of Cincinnati and Chicago has just returned from a trip south to enlist the support of Louisiana and Mississippi for the Barkley-Vinson stream purification bill soon to be introduced in Congress. Mr. Reardon is a member of the Cincinnati Stream Pollution Committee formed to prevent the pollution of the source of drinking water for Cincinnati and the Ohio Valley.

Arthur B. Shelby, vice-president and general manager of the Calaveras Cement Co., San Francisco, Cal., has returned from a month's trip through Colorado, Texas and other western and southwestern states.

Dr. Frederick Gardner Cottrell has been chosen to receive the 1937 Washington Award, made annually by the Western Society of Engineers, for his work in the extraction of helium gases on a commercial scale. Dr. Cottrell is head of Research Associates, Inc., and the Western Precipitation Co. He is well known in the nonmetallic-mineral industries for the equipment he designed for the electrical precipitation of dust from waste gases. The system has had wide use in the cement industry.

E. J. Haines has been appointed civil engineer at the plant of Gypsum, Lime & Alabastine Canada, Ltd., in Beachville, Ont. This plant produces the lime required at the operations of the American Cynamid Co., Ltd. at Niagara Falls, Ont.

Leslie L. Andrus, assistant sales manager of the American Foundry Equipment Co., Mishawaka, Ind., for the past two years, has been appointed general sales manager in charge of all sales, service and advertising.

W. Harlan Henszey, district manager of The Patterson Foundry & Machine Co., Philadelphia, Pa., has announced the appointment of George L. Anderson as sales engineer.

John A. Blank has been named chemical engineer of the Cement Process Corp., 90 Broad St., New York, N. Y., in charge of the cement-plant division, and is located at Allentown, Pa. The Cement Process Corp. controls the Blank patents for processes covering the manufacture of masonry and all-purpose cements. W. Kuntz is in charge of the lime-plants division of the concern and is located at York, Pa.

J. M. Nelson has purchased the plant and quarry of the E. B. & A. L. Stone Co. located near Fairfield, Cal. He had been superintendent of the operation for several years. The plant supplies crushed stone for most of the road building and maintenance work in that vicinity.

Fred R. Schulz, traffic manager, Buffalo Slag Co., Federal Portland Cement Co., and Federal Crushed Stone Corp., of Buffalo, N. Y., has been elected president of the Transportation Club of Buffalo.

Roy S. Adkins has been made general sales manager of the North American Cement Corp., according to an announcement by Thomas J. Harte, vice-president. Other appointments include William S. Brownson as assistant general sales manager of the cement division and Albert R. Couchman as assistant general sales manager of the lime and other products division.

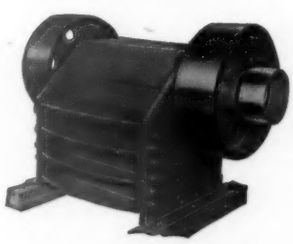
Harold P. Greenwald has been appointed supervising engineer of the Pittsburgh Experiment Station of the U. S. Bureau of Mines. Mr. Greenwald succeeds William P. Yant, who recently resigned to accept an executive position with an industrial concern.

R. L. Regester, 6823 Thomas Blvd., Pittsburgh, Pa., has been appointed sales representative of the Audubon Wire Cloth Corp. in the Pittsburgh district.

Neil Hodges has established a sand-and-gravel plant near Dundee, Ore.

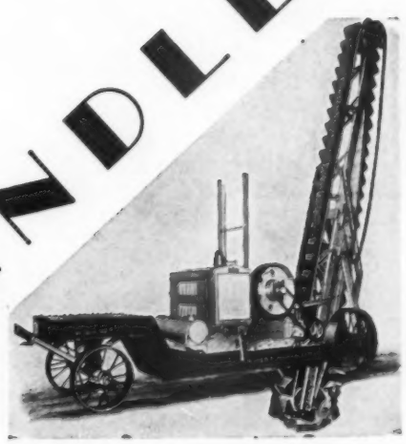
10 to 4000 Tons Daily

at "Rock-bottom" Crushing Costs



"One Reduction" Roller Bearing Jaw Crusher for producing uniform cubical material free of flats and chips.

GRUENDLER



New balanced Portable Crushing Plant ideally adapted for Road Side Operations. Large or small jobs easily handled by these efficient units.

GRUENDLER CRUSHER & PULVERIZER COMPANY

2915 North Market Street, Dept. PQ, ST. LOUIS, MO.

LOW COST CRUSHING FOR 52 YEARS

ATLANTIC PNEUMATIC ROCK BREAKER

FAST
LOW COST
SIMPLE

NO Explosives Plugs—Feathers

A revelation in breaking up large rocks and boulders—especially in ditches and excavations. Made of famous ATSCO Steel, specially heat treated. Fits standard pneumatic Paving Breakers. No additional equipment of any kind new or needed—no sharpening—no dressing—no hardening. Simply drill about a 12" hole in rock, place Rock breaker on drilled hole, and after short pounding with Pneumatic Paving Breaker, the rock will split. In use by many leading contractors, city departments, mines, gas and water companies. Send for circular R-B.

Atlantic 33 Non-Tempering Tool Steel for Chisels and Blacksmith Tools. Forge, Heat and then Throw in Water. No Drawing Necessary. Great Time Saver.

ATLANTIC STEEL CO.
1775 BROADWAY
NEW YORK, N. Y.

HAISS LOADERS

Have What It Takes

S-T-A-M-I-N-A

. . . the strength that comes from simple design, amply heavy structural members, a factor of safety in every part that will withstand a *stalling* overload. Big engines, heavy locomotive-type transmission, manganese chains and sprockets. LOW UPKEEP throughout.

5 yds. a min.
Model 135

•

3 yds. a min.
Model 80

•

2 yds. a min.
Model 27

WRITE, WIRE OR TELEPHONE
HAISS

George Haiss Mfg. Co., Inc., 142nd St. & Rider Ave., New York

Who, for over 40 years, have created and sold none but equipment of demonstrable superiority in design and manufacture.

Clamshell Buckets—Portable Conveyors

P. G. DAWSON, secretary of the Medusa Portland Cement Co., Cleveland, O., has been made vice-president, treasurer and a director of the company. He succeeds the late E. J. Maguire. Mr. Dawson has been in the cement industry for 23 years, starting with the Newaygo Portland Cement Co., a subsidiary. In addition to his new position, he continues to serve as secretary of the Cement Transit Co. of Michigan, another Medusa subsidiary. FRED PICKFORD, who has been assistant secretary of Medusa, is now secretary.

RAYMOND WILSON, head of the conservation activities of the Portland Cement Assn., and widely known for his studies in the technology of cement, has resigned and joined the Lehigh Portland Cement Co. His successor is H. S. PONZER, who has assisted Mr. Wilson for the past seven years. D. R. MACPHERSON has been transferred from the P.C.A. research laboratory to the conservation bureau where he will assist Mr. Ponzer.

J. H. MITCHELL-ROBERTS, export manager for Oliver United Filters Inc., left the latter part of January for an extended trip throughout the Far East, visiting in the Philippines, Japan, Australia and other countries.

LOUIS B. NEUMILLER has been named sales manager of the central sales division of Caterpillar Tractor Co. EDW. W. JACKSON has been promoted to the office of general service manager, the position held by Mr. Neumiller prior to his advancement.

H. D. RAFF, 65, president and general manager of the Diamond Portland Cement Co., Middlebranch, O., died of a heart attack at Canton, O., a few weeks ago. He had undergone an operation in a Canton hospital and was reported to be progressing favorably when stricken. Many years ago he designed and constructed a cement mill at Dallas, Tex., remaining as general superintendent. In 1907 he became superintendent of the Diamond company. In 1927 he became vice-president and three years later was elected president. He has been succeeded by R. D. RAFF, formerly vice-president.

J. F. MAX PATITZ, chief consulting engineer, Allis-Chalmers Mfg. Co., Milwaukee, Wis., died suddenly of a heart attack Jan. 3. He was associated with Allis-Chalmers for more than 50 years, nearly 26 of which he served as consulting engineer.

JAMES H. SWANGO, 66, president and treasurer of the Wabash Sand & Gravel Co. of Terre Haute, Ind., died of a heart attack at his farm near Terre Haute on January 14. He had been in apparent good health up to this time. He returned only two days before his death from Jacksonville, Fla., after a brief visit with his family. Mr. Swango was widely known to sand-and-gravel producers in western Indiana and eastern Illinois.

BEN STONE, well known sand-and-gravel producer in Indiana and long active in the affairs of the Indiana association, died suddenly at his home in Indianapolis recently. He was 57 years old and managed the plant of the Merom Gravel Co. until last summer when he formed the Stone Sand & Gravel Co. and began operating at a plant near Greenfield, Ind.

JOSEPH W. MCNAB, founder of Ontario's first cement-block manufacturing plant, located at St. Anne, near Belleville, passed away recently following a brief illness.

DR. RICHARD V. MATTISON, 85, former head of the Keasby & Mattison Co., makers of magnesia and asbestos products, passed away at his Philadelphia home recently.

TRADE NEWS

Acclaimed to be the most extensive and thoroughly equipped Diesel show-rooms in America are those of the Cummins Diesel Sales Corp. of Illinois at 2001 S. Michigan Ave., Chicago.

On display are 10 Cummins engines. All attractively displayed on chrome-plated stands. A large parts department is on the mezzanine. Offices are located between the corner show room and the service shop.

Appalachian Coals, Inc., was host Jan. 11 to more than 100 fuel engineers and sales managers of its constituent companies who attended the Seventeenth Fuel Engineers' Meeting. Principal speakers were Dr. Reinhardt Thiessen, research chemist, Pittsburgh Experiment Station, U. S. Bureau of Mines; J. J. Brennan, research engineer, Northern States Power Co., Minneapolis; R. M. Hardgrove, engineer, The Babcock & Wilcox Co., New York, N. Y.; E. P. Ogden, consulting ceramic engineer, Columbus, O.; and E. L. Greever, attorney, Tazewell, Va.

Bay City Shovels, Inc., Bay City, Mich., has let a contract for a new 200-ft. by 85-ft. factory building. Of fireproof, daylight construction this addition of 18,000 square feet of floor space will match in design and connect with the present assembly division. Other new equipment includes a considerable quantity of latest design machine tools, and a new overhead traveling crane.

Foreign Developments

Research Determines Two New Calcium Hydrates

By means of chemical and X-ray investigations it was determined that it is possible to yield two salts with the formula $4CaO.Fe_2O_3.nH_2O$, thereby verifying the opinion stated by I. Pelouze in the year 1851. The two forms are distinguished in water content and in structure; one contains 14, the other 7 mols of water. Two calcium ferrite hydrates were ascertained as hydration products of dicalcium ferrite and tetracalcium aluminate ferrite, both white in color and stable in contact with lime water to calcium hydroxide concentrations of 640 mg. per liter and of 1,060 mg. per liter. The hydrate stable above the concentration point of 1,060 mg. per liter was recognized chemically and by X-ray as tetracalcium ferrite hydrate. The latter hydrate forms even at concentrations well below the critical concentration. Between the limits of 1,060 and 640 there is a hydrate the formula of which was not ascertained. Under the concentration of 640 there is no calcium ferrite hydrate in equilibrium with the solution; hydrolysis occurs, forming free iron hydroxide.

When in the hydration of dicalcium ferrite the solution concentration of 1,060 mg. of CaO per liter is reached, the two mentioned calcium ferrite hydrates are formed. In the hydration of tetracalcium aluminate ferrite the solution concentration occurs at 640 mg. CaO per liter, the end products of the hydration reaction being the ferrite hydrate of lower lime content, iron hydroxide and tricalcium aluminate hydrate.

Researches with monocalcium ferrite show that this compound has practically no reaction with water and lime water.—Dr. Hellmuth Hoffman in *Zement* 25:675-680, 693-698, and 711-716, Sept. 24 and Oct. 1 and 8, 1936.

Requirements and Tests for Highway Cements

A review of the literature concerning cements for highway construction shows strikingly that until recently there was no uniform conception of the suitable composition of Portland cements for concrete highways. The research board created in 1934 by the general inspector of German highways was therefore confronted with the problem of developing from its own resources a cement best adapted to road construction. In the course of the work of the research board the most important requirements of road-building cement were worked out and test methods established right in the plants furnishing the cement. The next question was how the properties recognized as essential, namely, high bending and tensile strength along with high compressive strength and low shrinkage, can be achieved in cement production.

Large-scale and laboratory investigations have shown in this regard that Portland cements of approximately the desired properties can be obtained through variation of the mineral composition, in so far as the most favorable properties can be attained with high tricalcium silicate content (60 per cent. and more) and a lowered amount at melt phase (27 plus or minus 5 per cent.) with an alumina modulus of about 1.8 (under some conditions even lower). However, a change of the chemical composition is only effective in connection with sharply burned clinker, in which the free lime content is less than 1 per cent. The specific surface of the ground cement must in this connection be held within certain limits, as further fine grinding affects unfavorably the shrinkage behavior.

These conclusions correspond in part with recent experiences abroad, especially in Sweden and the United States. —G. Haegermann and H. E. Schwiete in "Strasse" Publications Series 4, pages 12-16, reviewed in *Tonindustrie-Zeitung* 60:1094, Nov. 2, 1936.

Further Studies on Cement for Road Work

In the course of an investigation on the properties of cement desirable in the construction of concrete highways, and the obtaining of these properties in the manufacture of cement, the influence of the free-lime content was studied in large-scale tests at a cement factory, using heterogeneous and consequently unfavorable raw material. It was found that even a small content of free lime which did not show up in the soundness tests had an unfavorable in-

YOUR *Kind of Pipe*

Conveying water over 5,000 feet from river to washing screens

In this light-walled pipe you have the bursting strength, the collapsing strength and even the stiffness of wrought pipe weighing twice as much. By cutting the weight in half you cut the transportation cost, handling cost, and erection cost. Let Taylor Spiral Pipe cut the cost of water lines and sand or gravel lines. Large stocks and facilities assure prompt deliveries.

Taylor Forge & Pipe Works
General Offices and Works:
Chicago, P. O. Box 485
New York Office:
50 Church Street
Pittsburgh Office:
Gulf Bldg.

Ask for the
Spiral Pipe Catalog
No. 36

TAYLOR
Spiral PIPE

of Nat-Aloy Wire Cloth

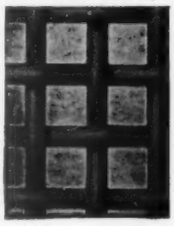
★ Wears five to ten times as long as cloth made of ordinary steel.

★ Withstands vibration without crystallization.

★ Super-tough to resist abrasion.

★ Maintains accuracy throughout life of screen.

★ Economical in price and serviceability.



Attractive Prices
Immediate Shipments from Stock

Write for New Catalog No. 36

NATIONAL WIRE CLOTH CO., INC.
ST. PAUL, MINN.

BACON FARREL CRUSHERS

Complete Plants Designed and Equipped. Screens, Elevators, Conveyors, Quarry, Sand and Gravel Plant Equipment. Engineering Service.

EARLE C. BACON, Inc.
71 John Street York, New N. Y.

fluence on strength, especially at the later periods, from which it was concluded that the tests at 28 days do not give an appropriate report on the quality of cement, and that the free-lime content should not exceed 1 per cent.

A further large-scale investigation, at a cement plant, was concerned with the question of the influence of chemical composition. It was shown that with increasing content in tricalcium silicate the strengths increase and shrinkage decreases.

Investigations on the influence of the fineness of grinding of a sharply burned, high-lime rotary-kiln clinker with good properties showed that with decreasing fineness of grinding shrinkage, bending strength, compressive strength and modulus of elasticity decrease, but that in this connection the shrinkage decreases more than the strengths, so that a coarser grinding can in many instances be an advantage. In the case considered the most favorable fineness of grinding was found to be about 15 per cent. residue on the 4900-mesh sieve, while the cement actually was being put on the market at between 9 and 11 per cent. It is therefore suggested as a principle that the quality of a clinker be so determined that good strength properties will be achieved with coarser grinding.—H. E. Schwiete and H. zur Strasse in *Die Betonstrasse,* September, 1936, pages 2109-214, reviewed in *Tonindustrie-Zeitung* 60:1094, Nov. 2, 1936.

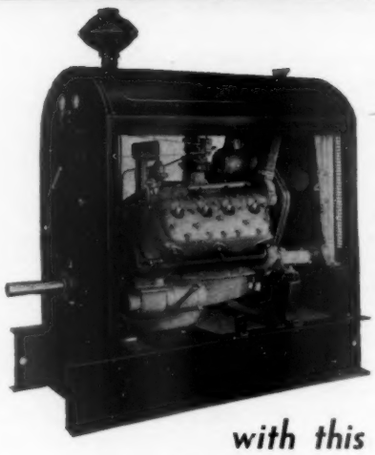
Steam-Cured Concrete Proposed for Paving

On the basis of recent laboratory and theoretical investigations of the steam-curing of concrete, the French engineer E. Leduc proposes the construction of concrete roads and streets with steam-cured concrete blocks, set in a thin mortar bed over a base course of concrete. Nowhere else is the problem of shrinkage so great as in the construction of roads; also, the laying of the steam-cured slabs makes it possible to open the road to traffic in a considerably shorter period, which is a decided economic advantage. The construction of such a road near Marseilles is described. To a question and note of caution by the editors of the magazine, Leduc defends the method on the points of ultimate economy and practicability.—*Tonindustrie-Zeitung* 60:1134-1135, 1147-1148, Nov. 16 and 19, 1936.

Hot-Cement Reactions Subject of Studies

Because of the differences of opinion existing in regard to the use of cement delivered hot to the building site, whether as a result of immediate de-

LOW COST POWER



with this

K R W FORD V8 UNIT

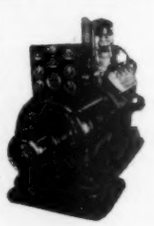
Here's dependable, low-cost power up to 60 H. P.—complete, compact, portable. Ideal for compressors, pumps, hoists, belt conveyors, bucket elevators, crushers, drag lines, drag scrapers, dryers, portable conveyors, loaders, blast hole drills, welders, etc., etc.

Assembled with brand new heavy duty Ford V8 Truck engine. Large capacity radiator protected by heavy screen. Engine rubber mounted — outfit complete with governor, gas tank, 17 plate battery, instruments and louvered side panels to thoroughly enclose the engine.

WRITE for complete information, price, and data showing how this unit will *pay for itself out of savings* in a few weeks, whether operated on gasoline or natural gas. You can buy through your Ford Dealer and benefit by local service and low-cost Ford engine replacement feature.

Also K R W Electric Plants

Produce your own electric power at a fraction of present cost. Eliminate peak load and stand-by charges. The most complete plant ever devised—both 110 and 220 volts at same time—every protective device—20,000 watts. Runs on gasoline or natural gas.



K. R. WILSON, 4 Lock St., BUFFALO, N. Y.
Exclusive Builder of Approved Ford Shop Equipment Since 1916

livery from the grinding mills or in consequence of summer temperatures, comparative tests were made on mortars and concretes mixed with both cements and water at varying temperatures. The investigations here reported were of a preliminary nature, but in spite of occasional losses of strength in some of the specimens or series, or other unexplained phenomena, it seems that it can be concluded that the use of such hot cement (up to about 70° C.), where the initial hardening is 3 to 4 hr., is not disadvantageous. The soundness (constancy of volume) and boiling tests were satisfactory; as had been expected, the only considerable increases in temperature on setting were with the cements at room temperature. Some of the tests show a possibility that with cements of short initial hardening and set the conditions of setting at high temperatures are not the same as at standard temperatures; further investigations are being made on such questions growing out of the preliminary studies.—Prof. L. Krüger, *Zement* 25:741-743, Oct. 22, 1936.

Roman Technology on Cement and Concrete

Study and analysis of the concrete in the bridge built by Trajan across the Danube in the year 101 shows that the cement was a Roman cement produced by the calcining of marl, the chemical composition lying between the following limits: silica 22.2 to 24.8 per cent., alumina 12.6 to 14.6 per cent., iron oxide 3.36 to 3.8 per cent., lime 57.22 to 59.43 per cent., and magnesia 0.24 to 1.77 per cent. The granulometric composition of the concrete consisted of one-third of fine sand and two-thirds of coarse aggregates. To each cubic meter of concrete 300 kg. of cement was used. The mixing ratio was 1 part of cement : 2.1 parts of sand : 2.6 parts of broken brick. The compressive strength of the concrete has reached 305 kg. per sq. cm.—S. C. Solacolu in *Bull. de Mathematiques et de Physique Pures et Appliquees,* 5, No. 1, 17/18, 1935/36, reviewed in *Zement* 25:849, Dec. 3, 1936.

Influence of Storage on Cement Properties

Portland cement stored in silos showed no loss in physical and chemical properties after storage for five months in silos. In the case of natural cement there was a loss in strength because of the conversion of *beta* to *gamma* dicalcium silicate. In the case of storage in jute and paper sacks there was a noticeable drop in strength results and in chemical-physical properties; this effect was most pronounced in jute sacks. The loss in compressive was less than the loss in tensile strength, although this difference was not as great in the case of natural cement. Natural cements showed the absolutely greatest alterations on account of the greater porosity of the clinker and the lower stability of the beta dicalcium silicate. In investigation of the dependence of the behavior of the cement on the chemical composition it was determined that the cements high in aluminate tend more to absorption of moisture, but that the diminution in strength was not as great on a percentage basis as would be expected.—*Il Cemento Armato—Le Industrie del Cemento,* April, 1936, reviewed in *Zement* 25:831, Nov. 26, 1936.

The General Refractories Co. has announced the appointment of H. R. Weller as district sales manager at Cleveland. Mr. Weller succeeds John C. Hopkins who has resigned to become associated with the Wellman Engineering Co."

A reprint in pamphlet form of an article published in the August, 1936, issue of PIT AND QUARRY entitled *Refractories Used in Lime Burning* has been published and is available in that form on request to the General Refractories Co., Philadelphia, Pa.

APPROVED
By U. S. BUREAU of MINES No. BM 2111

COVER'S DUPOR PLATE No. 24

★ Here is a NEW RESPIRATOR that provides U. S. Bureau of Mines Approved protection against "Type A" or Pneumoconiosis (SILICOSIS) producing dusts! New design eliminates Screw Caps! Filter pads firmly anchored prevent leakage! Filter Apertures increased to 24 square inches! Bureau of Mines Approved Face Cloth for comfort! Clear Vision Assured—Compact, fits the pocket—Weighs only 4 ounces (without pads) —Long Filter Life at Low Cost! Write for details—Price $27.00 per dozen.

Sample Sent Postpaid **$2.25**

Pat. Dec. 22, 1936, No. 2,065,304

H. S. COVER
Chippewa "B", South Bend, Ind.

AMERICAN HAMMERMILL CRUSHER

Capacity 10 to 100 Tons

—and that means **sustained hourly capacity,** day in and day out, with no interruptions of service, for the American is efficiently designed and ruggedly built for trouble-free operation. Remember your crushing plant is as good as the crusher you put into it, and an American-equipped portable or stationary plant is your best assurance of profitable production.

Bulletins on request

AMERICAN PULVERIZER COMPANY
1245 Macklind Ave. St. Louis, Mo.

Traffic News Digest

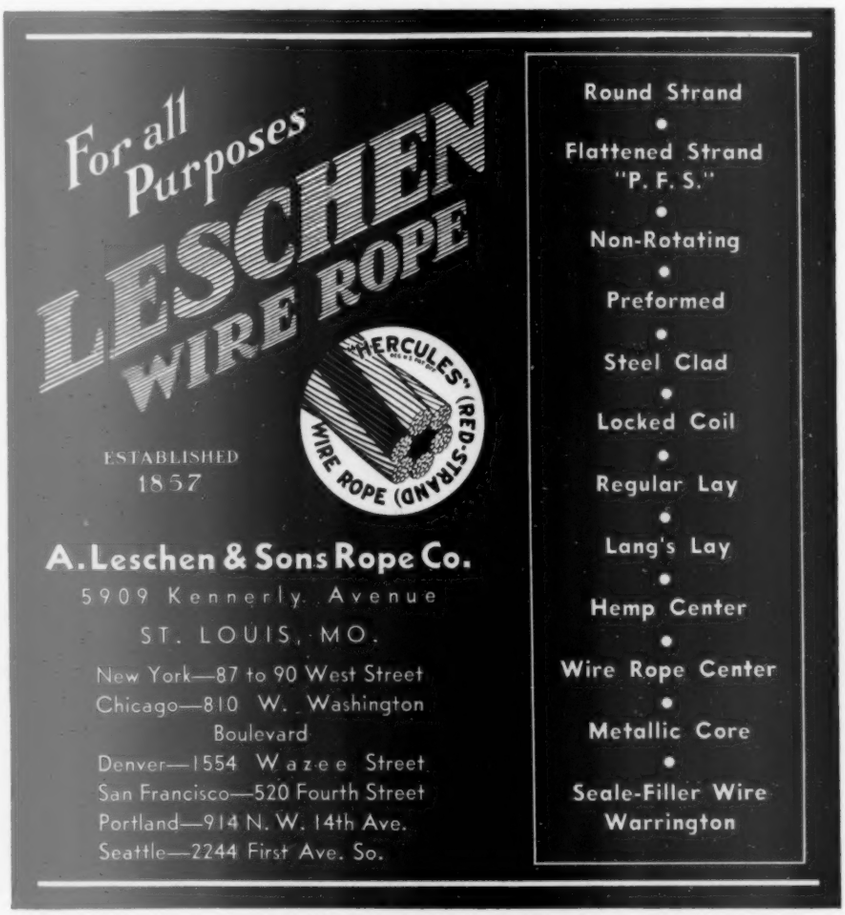
Legislation

Now that Congress is again in session a number of bills affecting transportation have been thrown into the legislative hopper. Most of these are bills which died with the close of the last Congress and which have been reintroduced. One which is of general interest is the Pettengill Bill, H.R. 1,668, introduced by Representative Pettengill of Indiana, which provides for repeal of the long-and-short-haul clause of Sec. 4. This bill was referred to the House Committee on interstate and foreign commerce. The congressman spoke in favor of his bill at a luncheon meeting of the Traffic Club of Chicago on January 18. Opposition to the bill is developing among motor carriers. The hearing on the bill was begun on January 28 before the House Committee with Representative Lea of California as chairman. The Assn. of American Railroads presented only one witness, after whom witnesses for railroad labor organizations were heard. Testimony of shippers who were in favor of the bill was given by J. P. Haynes, chairman of the special Fourth Section Committee of the National Industrial Traffic League.

Other bills which will be considered later include those designed to insure a full crew on all trains and to limit the length of a train; to provide for the installation of various safety devices in connection with the operation of the railroads and to provide for inspection and investigation of the conditions prevailing in train-dispatching service and for the establishment of rules and regulations governing the working conditions of train dispatchers to require railroads to maintain safe track bridges; to provide for the regulation and survey by the Bureau of Public Roads of a system of three East-West and six North-South superhighways; to enable sightless persons to be accompanied by "seeing-eye" dogs in interstate commerce without additional cost; to provide for the completion of the construction of the ship canal across Florida; to amend the Interstate Commerce Act to prohibit reduction of freight rates from railway shipment points on account of indirect water competition; to limit the appointments whenever made by the Interstate Commerce Commission so that not more than one individual from any one Federal Land Bank district shall serve thereon; to provide for an inquiry as to whether coastwise traffic should be subject to regulation by the commission; to provide for the protection and conservation of rights resulting from railroad land grants; to amend the Interstate Commerce Act to provide for the regulation of the transportation of passenger and property by aircraft in interstate traffic; to prevent the pollution of navigable water of the United States; to limit the hours of labor to 30 a week; to encourage uniformity of highway-traffic regulation and promotion of safety on public highways; to amend Par. 5 of Sec. I of the Interstate Commerce Act by adding the following: "And provided further, that all such charges for the transportation of property between the different rate-making or geographical sections of the United States as now designated or may hereafter be designated by the Interstate Commerce Commission for rate-making purposes be so adjusted as to cause no greater charge for the transportation of property moving from one rate-making or geographical section into another rate-making or geographical section than the charge for the transportation of the same or like classes of traffic moving wholly within the destination rate-making or geographical section, distance considered; and wherever distances exist entitling railway carriers in one rate-making or geographical section to higher revenues than carriers in another rate-making or geographical section, such differences in revenue needs shall be recognized in divisions of rates among the several carriers affected".

Other transportation bills would terminate the revenue taxes on motor vehicles and accessories, tires and tubes; would require licensing of drivers of motor vehicles in interstate commerce; would authorize and provide for the construction, maintenance and operation of an inter-oceanic canal through Nicaragua; would authorize a federal loan of $12,000,000 for constructing two 8,000,000-cu. ft. American designed dirigible airships, a large American airship plant, and an Atlantic operating terminal, and to establish twice-a-week American commercial airplane service; would continue the life of the Reconstruction Finance Corp. and may make loans to railroads; would establish a United States Administrative Court which would have jurisdiction to review the action of the Interstate Commerce Commission over the granting and revocation of licenses, permits, registrations or other grants for regulatory purposes including the suspensions thereof; would require the commission to establish and enforce preferential rates on shipments of cotton based on the cubic contents of the bale; would make certain crimes committed on interstate carriers offenses against the United States; would provide for air safety regulation by the commission; would amend the air commerce act to provide for the safety of passengers in aircraft.

The investigation of the railroads being conducted by the Senate Interstate Commerce Committee will likely develop further railroad legislation. This investigation among other things pried into the structures of the various holding companies.

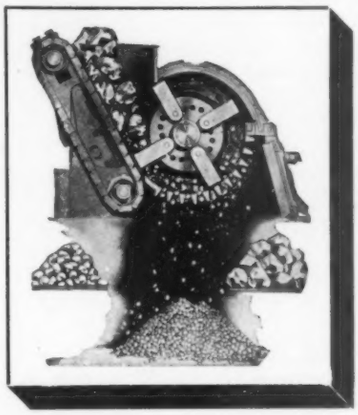


Recent I. C. C. Decisions

Crushed Stone, Slag and Gravel.—In response to Fourth Section applications Nos. 16,138 and 16,192 the carriers who were parties to Pope's I. C. C. No. 1,635, have been authorized to establish interstate rates on crushed stone, slag and gravel from points in Alabama, Georgia and South Carolina and from intermediate points from which the rates from the origins specified were observed as maxima, to Charleston, S. C., Savannah, Ga. and Jacksonville, Fla., without observing the long-and-short-haul division of Sec. 4 subject to the usual circuity limitations. I. C. C. FSO No. 12,628.

Lime.—In response to Fourth Section application No. 16,296 the carriers have been authorized to maintain over existing routes a rate not less than $1.90 a net ton, carload minimum weight 80,000 lb., on pebble lime from points in Pennsylvania, Maryland, Virginia and West Virginia to Edge Moor, Del., and Phoenix, N. Y., without observing the long-and-short-haul clause of Sec. 4, I. C. C. FSO No. 12,629.

Sand.—In a report on further hearing the commission has modified some prior findings and has awarded reparation and authorized Fourth Section relief in connection with a number of cases which were consolidated under the title "Industrial Sand Cases 1930." One feature of the award of reparation was that it required a shipper to route his traffic over the shortest route or one not more than 15 per



DIXIE

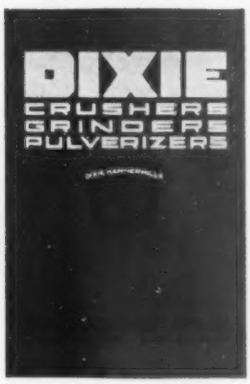
NON-CLOGGING

HAMMER MILL

• FORTY • SIZES •

• is the only crusher with a super-tough moving breaker plate that is 26 times the average area. The result is maximum crushing power with minimum maintenance. That is why DIXIE gives record low costs in producing uniform, cubical material.

Built in 40 different sizes for all requirements in Primary, Secondary and Fine Reduction. Write for your copy of the Dixie Catalog, which gives full details and specifications.



DIXIE MACHINERY MFG. COMPANY
4209 Goodfellow Ave., St. Louis, Mo.

cent. circuitous as a condition necessary to the recovery of reparation if the rate was found unreasonable. On this particular point Commissioner Caskie dissented. A great number of cases mostly involving a small amount of reparation were included in this report but nothing further in the decision departed from previously announced principles. The numbers of the cases included and other details will be furnished on application.

Examiners' Reports

Cement.—Examiner Carl A. Schlager proposes that the commission find the rate of 46c charged on cement from Laramie to Buffalo, Wvo., via an interstate route between June 5, 1929 and April 16, 1934, applicable and not unreasonable and dismiss the complaint in I. C. C. Docket No. 27,314, Monolith Portland Midwest Co. *v.* Wyoming Railway Co. *et al.*

Crushed Stone.—Examiner Harold M. Brown recommends that the commission find that the applicable rate of $1.10 plus a 7c emergency charge on crushed stone from Marquette, Mo. to Leechville, Ark., not unreasonable. Shipments were made between May 18 and 21, 1935 and charges were collected on a rate of 90c, which defendants had agreed to publish but which was not established until several months after the shipment moved. He recommends that this complain be dismissed. I. C. C. Docket No. 27,489, D. F. Jones Construction Co. *v.* St. L. S. W. *et al.*

Gravel.—Examiner John Davey proposes that the rate of 95c a net ton charged on gravel from Riverton, Ind. to Bethel, Ill., on shipments between Oct. 25 and Nov. 7, 1935 be found unreasonable to the extent that they exceeded 60c and that reparation be awarded in I. C. C. Docket No. 27,551, Merom Gravel Co. *v.* I. C.

Lime.—Examiner F. R. Linn in a recommendation authorizing H. Hunter Fultz to operate as a common carrier of lime and other commodities by motor vehicle between Leesburg, Va., and various destinations said that the applicant had been operating without a certificate and in violation of the Motor Carrier Act and should discontinue such operations until a certificate of authority had been granted by the commission.—I. C. C. Docket No. 50,249.

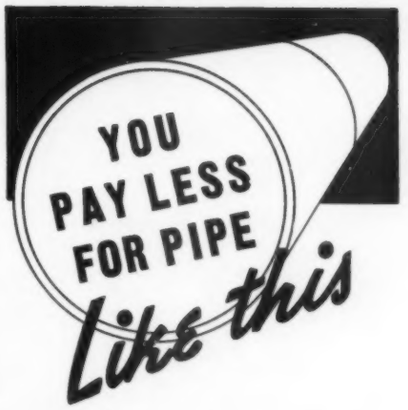
Sand.—Examiner W. A. Disque recommends that the rate on common sand of $1.15 from Massillon, O., to Wampum, Pa., be found unreasonable to the extent that it exceeded $1 on shipments moving between Sept. 7, 1934 and Aug. 25, 1935 and that reparation be awarded in I. C. C. Docket No. 27,496 Federal-American Cement Tile Co. *v* Pennsylvania.

Examiner C. W. Griffin recommends that the commission find various rates on sand unreasonable to the extent that they exceed the following: molding sand from Elnora, N. Y., to Gardner, Mass., $2.20; from Ushers, Schuylerville and Saratoga Springs, N. Y., to Worcester, Mass., $2.45; silica sand from Millville and Manumuskin, N. Y., to Worcester, Mass., $3.80 in box-cars and $3.40 in open-top cars when routed in connection with the Reading Co., and $4.00 in box-cars and $3.60 in open-top cars when routed in connection with the Pennsylvania R. R. He proposes an award of reparation.—I. C. C. Docket No. 27,473 Florence Stove Co. *v.* B. & M. *et al* and No. 27,498 Arcade Malleable Iron Co. *v.* B. & A. *et al.*

New Complaints Filed

Plaster.—The commission has suspended from Jan. 21 to Aug. 21 schedules in Sup. No. 11 to Kipp's I. C. C. No. A2,351 providing that lime, not to exceed 25 per cent. of the total weight of the shipment may be included with carload rates applying on plaster from the Fort Dodge, Ia., district to destinations in

(*Continued on page 93*)



LIGHTER WEIGHT.. LONG WEARING... HIGH CARBON MANGANESE STEEL

Uniweld Pipe has two distinct advantages for abrasive service. Made of special high carbon-high manganese steel, it has unusual resistance to abrasive action: Because of this great wear resisting quality Uniweld Pipe can be made in lighter gauges which facilitates handling in the field.

As Uniweld compares in price with other pipe and has a considerably longer service life, it costs less in the end. For service, for ease of handling and for economy specify Uniweld Pipe. It can be furnished in different sizes, lengths and various types of ends to suit your particular requirements. Write for information.

WELDING ENGINEERS · UWCO · MIDDLETOWN, OHIO.

UNIWELD PIPE

THE UNITED WELDING CO.
MIDDLETOWN, OHIO

Occupational Diseases and the Law

Inhalation of Dust

McGuire v. Sherwin-Williams Co., United States Circuit Court of Appeals, 7th Circuit (Illinois), December 18, 1936. The plaintiff in this case sued in a common-law action for injuries growing out of the inhalation of stone dust alleged to be due to the failure of the defendant to warn him of the dangers and to furnish proper appliances for his protection. Judgment in the lower (United States district) court denying damages (the complaint was dismissed on motion of the defendant) is affirmed by the appellate court, on the ground that the Supreme Court of Illinois has definitely held (*McCreery v. Libby-Owens-Ford Glass Co.,* 2 N. E. (2d) 290, 363 Ill. 321; *Vogel v. Johns-Manville Products Corporation,* 2 N. E. (2d) 716, 363 Ill. 473) that recovery of an employee for injury to health due to occupational disease must rest upon statutory authority as no such right existed at common law in Illinois; for a Federal court to hold otherwise, in a suit such as this, involving a foreign corporation, would in effect give an employee in a factory of a non-resident corporation greater rights than those of an employee in a factory of a domestic corporation.

Questions for the Jury

Smith, Executrix, v. Harbison-Walker Refractories Co., Missouri Supreme Court, December 14, 1936. The plaintiff sued for damages on the ground that because of the defendant's alleged failure to comply with Sec. 13,232, 13,234, 13,252, 13,254 and 13,264, Missouri Revised Statutes, he inhaled dust containing silica and contracted silicosis. A judgment of $11,041.66 was obtained in the lower court. The Supreme Court reverses the judgment and remands the cause because of erroneous instructions given to the jury in the trial; in its written opinion, the Supreme Court construes the statutes concerned and outlines the questions of fact to be decided by a jury as follows:

Sec. 13,232 is a general requirement that certain establishments "shall be so ventilated as to render harmless all impurities, as near as may be." This the court construes to mean "as near as may be necessary for reasonable safety." An instruction permitting recovery for failure to do anything that was possible, rather than fixing the standard to be reasonable means and reasonable safety in the ventilation of places of work, was erroneous.

Sec. 13,234 places the duty to provide specified equipment for the removal of dust generated by a polishing wheel or machine directly upon an employer without any order or notice. To recover under this section if the employer does not provide the required equipment, it would not be necessary to prove that the injury was an occupational disease; an injury such as reactivation or aggravation of tuberculosis would entitle the employee to damages for the employer's negligence.

Instructions submitting violation of Sec. 13,252, 13,254 and 13,264 (occupational-disease act) were erroneous in omitting to require the jury to find the essential facts necessary to establish such violation; the fact issues upon which the plaintiff has the burden of proof were:

(1) Is silica dust a noxious, poisonous or disease-producing dust?

(2) Is there a disease of silicosis, which is peculiar to, or the natural result of, exposure to continuous breathing of silica dust?

(3) Was silica present in the dust produced by the defendant's grinders in such form and quantity as to produce the disease of silicosis?

(4) Could exposure to the dust produced by the defendant's grinders during the time when and in the manner which plaintiff was working about them or any of them produce the disease of silicosis?

(5) Did the hood and suction fan of a new grinder (installed during the period in question) effectively prevent the production of dust in such form and quantity as would produce the disease of silicosis?

(6) Did the plaintiff have the disease of silicosis?

(7) Did the plaintiff contract the disease of silicosis from being caused to breathe dust produced by reason of the defendant's failure to comply with any of the provisions of Sec. 13,252, 13,254 and 13,256?

The court further holds that certificates of approval of the condition of the defendant company's plant, after

FIGHT ICE AND FROST with 2000° HEAT

COMPLETE! 4 Gal. Tank, 60 lb. Gauge; Hand Torch which delivers flame of 2000°. 30" long x 3" wide; 7 ft. oil-resisting hose; snap-on shoulder strap. All for

$20

• The AEROIL NO. 99 TORCH is portable, efficient, economical, windproof and safe. It solves your Winter thawing problems quickly, doing the work of five men using old-fashioned methods. Thaws frozen loading gates, chutes, hoppers, conveyors, tipples, pockets, tracks, interlocking devices, derails, scales; water, steam, oil and air pipes; or any other frozen mechanism. Used to keep piles of sand, gravel and coal free from frost • *In Summer,* the AEROIL NO. 99 TORCH is invaluable as a weed burner, as a portable forge, to crack rocks where blasting is dangerous, to burn off old paint, to heat all bituminous materials and a hundred other uses • The AEROIL NO. 99 TORCH pays for itself in a few short days by saving you labor, materials and time. Send for folder No. 283S . . . it is FREE.

FREE TRIAL Try the AEROIL NO. 99 TORCH for 10 Days, and if, at the end of that period, you are not convinced that it will save you time, labor and money, return the torch for full credit. ORDER TODAY.

BURNS: KEROSENE, GASOLINE, COAL OIL, STOVE OIL OR LIGHT FURNACE OIL

AEROIL BURNER COMPANY INC.

West New York, New Jersey

178 N. Wacker Drive, CHICAGO — 469 Bryant Street, SAN FRANCISCO — 3408 Main Street, DALLAS

inspection by the Commissioner of Labor, were not a defense to the action; the duty to comply with the requirements of the statutes is placed directly upon the employer and does not depend upon any approval or disapproval of the Commissioner of Labor.

TRAFFIC (from page 91)

southern territory. This would result in reductions.—I. C. C. Docket I. and S. No. 4,297.

Sand.—Alleging an unreasonable rate on sand from Millville, N. J., to Worcester, Mass., reparation is sought in a complain filed by Robert H. Haley, Division Freight Agent in I. C. C. Docket No. 27,613 American Steel and Wire Co. of New Jersey, Worcester, Mass. *v.* Pennsylvania Reading Seashore Lines *et al.*

Complaining of unreasonable rates and charges on silica sand from Mapleton, Pa., to Port Jervis, N. Y., reparation is asked for in a complaint filed by Abner Pollack, practitioner, 1148 Manor Ave., New York, N. Y. in I. C. C. Docket No. 27,626, Gillinder Brothers, Inc., Port Jervis, N. Y. *v.* Pennsylvania *et al.*

In another complaint filed by Mr. Pollack reparation is sought on an alleged violation of Sec. 6 on the shipment of silica sand from Oregon, Ill., to Mt. Clemens, Mich., in I. C. C. Docket No. 27,633, Mt. Clemens Pottery Co., Mt. Clemens, Mich. *v.* C. B. & Q. *et al.*

The rates on molding sand from points in Illinois, New Jersey, New York and other states to destinations in Pennsylvania and Rhode Island have been attacked under Sec. I with a request for reparation in a complaint filed by L. V. Brand and Edgar O. Anderson, practitioners, 328 S. Jefferson St., Chicago, Ill., in I. C. C. Docket No. 27,637, Grinnell Co., Providence, R. I. *v.* B. & O. *et al.*

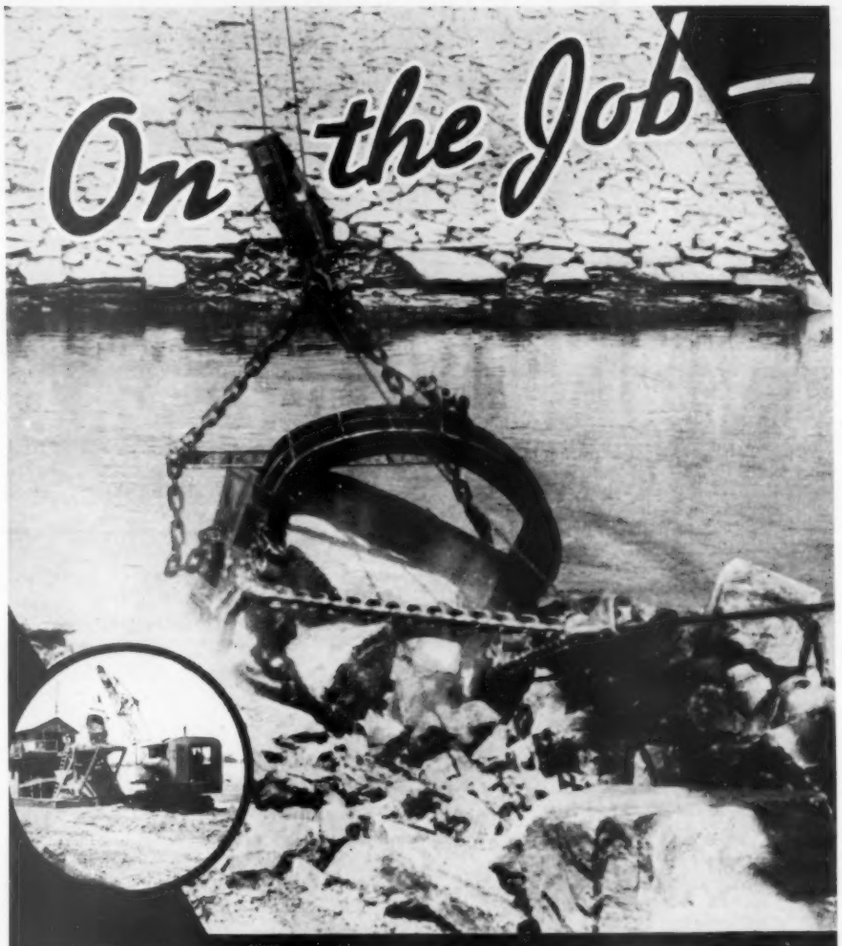
Sand and Gravel.—Alleging violation of Sec. I new rates and reparation are sought in connection with the movement of sand and gravel from Hawarden, Ia., to Meckling, S. D., in a complaint filed by A. R. Morgan, traffic manager, 108 W. 35th St., Minneapolis, Minn., in I. C. C. Docket No. 27,632, Larson-Erling Co., Sioux Falls, S. D. *v.* C. M. St. P. & P. *et al.*

Whiting.—The commission on its own motion has instituted an investigation on the intrastate rates on whiting in New Jersey Sec. 13. The New Jersey Commission has ordered the carriers to maintain rates on whiting the same as those currently applicable on ground limestone, whereas the normal basis of rates on whiting in official territory is Column 25.—I. C. C. Docket No. 27,612 Intrastate rates on Whiting in New Jersey.

Demurrage Charges.—The commission has suspended from Jan. 1 until Aug. 1 schedules in Sup. No. 1 to Jones' I. C. C. No. 2,944 proposing to establish a provision in connection with the rules governing car demurrage which would allow railway carriers at their option to terminate the average agreement arrangement for any breach of the terms thereof by shippers.—I. C. C. I. and S. No. 4,287.

Traffic News

Emergency Charge Case.—The hearing on the reöpened emergency-charge case began Jan. 6 in Washington with testimony of the railroads heard first. The testimony of the carriers had not been completed when the hearing was adjourned on Jan. 15. When the hearing was resumed on Jan. 26 the carriers announced that they had withdrawn some commodities from the proposed increase. The commodities withdrawn, however, did not include products of the nonmetallic-minerals industry.



PAGE AUTOMATICS
Prove they can
Increase Yardage 20% to 50%

Users Report Their Results With the Patented Rounded Front AUTOMATIC:—

* An Indiana contractor reports:
"Has increased our production at least 75%. To us, the Page Automatic is the only bucket for dragline work."

* An Illinois coal stripper writes:
"Last winter we purchased an 8-cy Automatic. It has increased our yardage, enabled us to dig harder burden that we could not dig before."

* A gravel plant owner says:
"This bucket has speeded up our operation. It comes up with a full load when working under 15 feet of water."

*From Letters in our files

Hundreds of AUTOMATIC users in every state and five foreign countries are increasing dragline yardage and profits. Ask them of their results—then see your equipment dealer or write us direct for information on an AUTOMATIC, best suited to your machine and job. Bulletin "The AUTOMATIC" gladly sent on request.

DIG WITH A PAGE AUTOMATIC!

Address Dept. F

BUILT IN SIZES 3/8 to 15 CUBIC YARDS

PAGE ENGINEERING COMPANY
CLEARING POST OFFICE CHICAGO, ILLINOIS

New Machinery and Supplies

Offers Small, High-Speed Convertible Excavator

The Northwest Engineering Co., builder of gasoline, electric, oil and Diesel-powered shovels, cranes and drag-lines announces a new ¾-cu.yd. shovel.

This machine, known as Model 25, is fully convertible from shovel to crane or drag-line by simply changing booms. The outstanding characteristic claimed for this unit is speed. Every effort has been made to assure fast action in all functions. Its design is similar in general to the recently announced Northwest Models 15 and 18, but it is larger and heavier throughout.

Speed is said to be the outstanding feature of this new ¾-cu.yd. shovel.

Bases are of cast steel. Side frames are cast integral with the rotating base. Travel gears are fully inclosed and the whole crawler design is engineered and built exclusively for shovel service. The "feather-touch" control, which assures easy operation, and the cushion clutch, which limits the hoist-rope pull to a definite value, are standard equipment. Swinging clutches are of the cone type. They are smooth acting, non-grabbing, and are cool running.

All high speed shafts are mounted on ball or roller bearings, and the power take-off is through helical gears running in oil in an oil-tight housing. Regular power is a Wisconsin 6-cylinder gasoline engine, but electric or Diesel power is available.

The shovel equipment is the standard Northwest welded boom and welded dipper stick, equipped with a manganese steel ¾-cu.yd. dipper. A full cab is standard equipment, and all operating parts above the deck are accessible within the cab.

Expanding Bowl Increases Capacity of This Scraper

A new "carryall" scraper to be manufactured in four capacities and called the Type U expanding carryall is announced by R. G. LeTourneau, Inc.

This scraper, with the exception of its bowl, is similar in design, construction and operation of other "carryall" scrapers. Its bowl consists of two buckets, the rearmost of which telescopes within the forward bucket. When loading, this rear bucket fills and is then carried back by a return spring, thus expanding the bowl capacity and increasing yardage 50 per cent.

The four sizes manufactured are 18-, 12-, 9- and 6-cu.yd. Chief revolutionary feature of the U Models is this: the U 18 has the same cutting width as the former 12-cu.yd. model,

Two-bucket bowl increases scraper capacity.

but due to its big tires and expanding bowl, loads extra yardage with virtually no extra tractor effort. Similarly the U 12 and U 9 have cutting edges equally respective to the 8- and 6-cu.yd. "carryalls."

PERFORATED METAL SCREENS

FOR SAND, GRAVEL STONE, ETC.

Manufactured exactly to your specifications.

Any size or style screen, in thickness of steel wanted with any size perforation desired.

We can promptly duplicate your present screens at lowest prices.

Prompt Shipment

CHICAGO PERFORATING CO.

2435 W. 24TH PLACE CHICAGO, ILL.

Telephone CANAL 1459

Grapple Tines Are Parallel and Operate Independently

A new four-tine Type H grapple, utilizing two parallel pairs of tines which function independently, gripping the object firmly on two of its sides, regardless of irregularities in shape or variations in width, is being offered by The Owen Bucket Co., Cleveland, O.

The unusual action is accomplished by incorporating a patented sheave block which equalizes the gripping power and eliminates the possibility of the stone or object rolling between the tines and dropping out.

New grapple which employs two parallel pairs of tines.

Recommended on all classes of stone work, the new Type H grapple is available in three standard sizes but can be furnished in any intermediate capacity to meet particular requirements.

Offers Portable Plant for Bituminizing Aggregates

Bituminous paving is opening up an excellent market for aggregates producers. With 90 per cent. of the material being in the form of aggregates, many producers have gone into the business of supplying bituminized materials for road construction.

A portable plant with a capacity of 300 to 400 tons per day has been placed on the market by the Maltby Asphalt Equipment Co., Buffalo, N. Y. Either hot or cold-mixed material can be produced and the finished material meets state specifications. Only five men are required to operate the entire plant which can be set up quickly or moved to another more convenient spot if required with a minimum of delay.

The Maltby company also handles pug-mills, vibrating screens, steel bins and conveyors.

High Efficiency Claimed for This Crushing Plant

The new Universal dual gravel-crushing, screening and loading plant illustrated is a modern development of the Universal Crusher Co. of Cedar Rapids, Ia.

Dual portable crushing, screening and loading plant.

The manufacturer claims high efficiency and low-cost operation for this compact plant which employs the following standard Universal equipment: a No. 936 jaw crusher, a 30-in. by 16-in. roll crusher, a 4-ft. by 8-ft. double-deck gyrating screen, and a sand rejector. The entire assembly is mounted on a heavy-duty goose-neck type six-wheeled truck with twelve pneumatic tires. A 52-ft. by 24-in. feeder belt conveyor; a 52-ft. by 18-in. delivery belt conveyor, and a 21-cu.yd. steel jackleg bin complete the assembly.

Universal portable plants of this type are made for handling 100 to 200 tons per hr. and over, other Universal plants in models to suit varying operating conditions being available in both portable and stationary types.

Compensated Belt Assures Equalized Ply Stresses

Two new styles of Condor compensated belt, known as Style F and Style B, have been developed by the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., of Passaic, N. J. Both have the patented Condor compensated principle of equalized ply stresses at the arc of contact, but are especially designed for those unusual conditions which require some slip rather than the extremely high coefficient of friction for low-tension operation present in the regular Condor compensated belt.

Style F has a red friction pulley surface and is designed for use where a slight starting slip is desired, while Style B has a bareback untreated duck pulley surface and is built for conditions calling for a greater slip, or where slip is essential, as in the case of winder drives.

There are no differences between the construction of these belts and that of the regular Condor compensated low-tension belt except for the pulley surface. Additional details are available from the manufacturer.

The Condor compensated principle of equalized ply stresses consists of building the belt to conform to the pulley curvature thereby relieving the excessive stresses thrown on the outer plies as occurs with standard flat belts and overcoming ply ruptures or separations, broken fasteners and prolonging belt life several times. This principle has been referred to by engineers as the greatest advancement in rubber belting since its introduction.

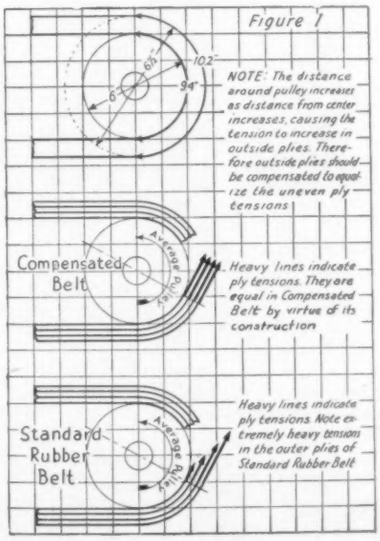


Figure 1
NOTE: The distance around pulley increases as distance from center increases, causing the tension to increase in outside plies. Therefore outside plies should be compensated to equalize the uneven ply tensions
Compensated Belt
Heavy lines indicate ply tensions. They are equal in Compensated Belt by virtue of its construction
Standard Rubber Belt
Heavy lines indicate ply tensions. Note extremely heavy tensions in the outer plies of Standard Rubber Belt

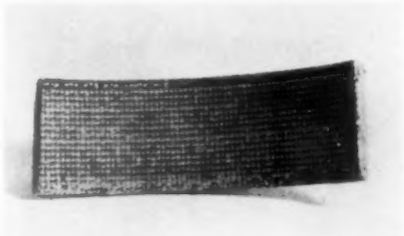
Chart showing how equalized ply tension saves belting.

Zinc-Asbestos Lining for Heavy-Duty Brake Service

A new heavy-duty brake lining which has been thoroughly tested in the automotive and industrial field and is said to give excellent results under the extreme conditions encountered in power-shovel operation has recently been placed on the market by the L. J. Miley Co., Chicago, Ill.

The lining is built of zinc wire and asbestos yarn, woven into a solid body. The material is then dipped into a high-temperature bakelite resin treatment under pressure. It is then calendered and baked and ground on both sides to exact dimensions. The result is a dense, homogenous mass which not only withstands heat but helps conduct heat away from the surface.

Miley heavy-duty lining is made in sizes up to and including ½ in. in thickness and can be produced in even greater thickness on special order.



Section of the brake lining.

CLEVELAND ROCK DRILLS

Cleveland Drills of every type—whether sinkers, drifters or stopers, are fast cutters, easy to handle, smooth in operation, and they all use less air than other drills of corresponding size. Whether your quarry requires primary or secondary drilling—or both, there is always a Cleveland that will save you money on drilling costs.

See our Full Page advertisement in the next issue of Pit and Quarry.

The Cleveland Rock Drill Co.
3740 East 78th St.
CLEVELAND, O.

PYRASTEEL
for high temperatures

PYRASTEEL kiln ends are being used from coast to coast, and in foreign countries.

They make tight sealing practicable. Most direct method of fuel economy.

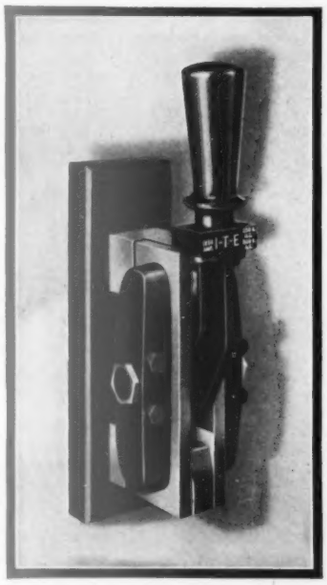
They are furnished completely finished, easy to attach.

Chicago Steel Foundry Co.
Kedzie Avenue at 38th Street
CHICAGO, ILL.
MAKERS OF ALLOY STEEL FOR 25 YEARS

BUFF-ALOY wire screening is made on automatic looms with painstaking care in weaving. Your screening plant will benefit economically if BUFF-ALOY is used for vibrating and sizing screens. Uniform meshes, hard wearing alloy of machinery grade and special weaves — BUFF-ALOY is guaranteed to outlast any other wire cloth of any other metal.

Investigate BUFF-ALOY! Send for Bulletin 101-B.

BUFFALO WIRE WORKS CO.
(Formerly Scheeler's Sons—Est. 1869)
526 Terrace, Buffalo, N. Y. — 11 So. 7th St., Philadelphia, Pa.



The **KLAMP-TITE** Switch

Recognized as a marked improvement in knife switch construction, the KLAMP-TITE holds its contacts under thousands of pounds constant pressure. One throw of the handle completes closing and clamping action.

An ideal switch for DUSTY installations

KLAMP-TITES add safety in cement plants and allied industries where dependability is law. *Send for Bulletin 1136.*

I-T-E CIRCUIT BREAKER CO.
Philadelphia, Pa. Dept. R *Offices in Principal Cities*

Low Cost of Air Is Claimed for Improved Compressor

Additional capacity with no increase in size is a feature of the new Curtis Model C compressor. Greater efficiency is obtained with a new type head equipped with large area short intake passages, oversize posts, straight-line air flow, and cooled air intake. The air enters the cylinder at a low temperature. Both peak pressure and temperature of compression are decreased. Excessive head cooling is avoided, evaporation of oil from piston and cylinder walls and precipitation of carbon is reduced.

High capacity without increase in size is claimed for this new air-compressor.

Centro-ring oiling provides positive lubrication; while Timken bearings assure reduced friction, longer life and makes adjustments easy.

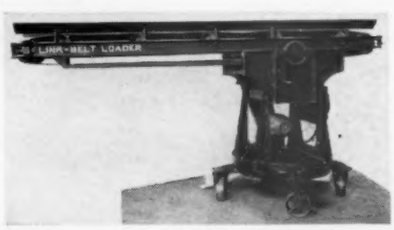
Because of the increased capacity, the cost of the air is said to be relatively lower.

These compressors are made in sizes from 3 to 60 h.p., the larger sizes being of "V" type, 4-cyl. construction and can be furnished either as simple machines for driving from a line shaft or motor, or can be supplied as complete self contained units, motor or gasoline engine driven.

Box-Car Loader Operates with Minimum of Dust

Announcement is made by Link-Belt Co. of the development of a new type of inexpensive box-car loader for handling bulk materials without creating a lot of dust or degradation in the loading operation.

The anti-friction belt conveyor constituting the loading element of the machine, is supported on a horizontal boom which is arranged so it can be racked back and forth, or rotated 360 deg., by hand, on the caster-mounted truck on which boom is mounted. The conveyor is operated at a comparatively slow speed, and has a discharge height of 5 ft.



Belt-type loader for handling bulk materials.

It is stated that in handling pebble lime with one of these loaders at an eastern lime plant, the degradation due to loading is practically eliminated, and that the amount of dust created has been reduced to a very desirable degree.

Being mounted on four large swiveling casters, it is possible for three men to move the machine into and out of cars. After it is in place, the services of but one man are required.

Coming Events

March 1-5, 1937, Chicago, Ill.—Group meetings of the A. S. T. M. committees. (1937 Regional meeting March 2 and 3). Palmer House.

June 28-July 2, 1937, New York, N. Y.—Fortieth annual meeting and exhibit, American Society for Testing Materials. Waldorf-Astoria Hotel.

New Principle Employed in This Motor-Feed Drifter

An entirely new principle in feeding drifting drills is found in the new motor-feed drifter recently introduced by the Gardner-Denver Co., Quincy, Ill.

The motor-feed drifter does not utilize vi-

DON'T BUY PIPE EQUIPMENT *until you do* **THIS**

1. Get a copy of our list of special offers in new and used concrete pipe machines and concrete pipe molds.
2. Check over the list and ask us to give you full details, price discounts on the machines you are interested in.

MACHINES—PIPE MOLDS

We handle every type of equipment necessary for the pipe manufacturer. Whether you purchase new or used equipment you can be sure that it comes to you exactly as we represent it to be. If you want to save money write for our listing of special offers — compare them with others. Do it today.

WRITE TODAY FOR THIS LIST

UNIVERSAL CONCRETE PIPE CO.
COLUMBUS, OHIO

The new motor-feed drifter.

bration and therefore has much smoother operation than the old-type vibration feed drills. It has a powerful, rapid return and has close feed regulation for varying ground conditions.

The Gardner-Denver motor feed model is available in two models, AF-79 as a 3-in. drifter and AF-89 as a 3½-in. drifter.

Because of a change in the internal organization of Combustion Engineering Co., Inc., the Raymond Brothers Impact Pulverizer Co. has become the Raymond Pulverizer Division of Combustion Engineering Co., Inc. No change in the administrative personnel is in contemplation.

Trade Literature

Fairbanks-Morse Diesels. 24 p. Fairbanks, Morse & Co., Chicago, Ill.

The Mixer You've Been Waiting For. 4 p. Concrete Transport Mixer Co., St. Louis, Mo.

LeTourneau Angle-Dozers. (Folder.) R. G. LeTourneau, Inc., Peoria, Ill.

Why Union Wire Ropes Excel. 12 p. Union Wire Rope Corp., Tulsa, Okla.

Pulverizers for Fine Grinding. 48 p. Whiting Corp., Harvey, Ill.

Raymond Roller Mills. 4 p. Raymond Bros. Impact Pulverizer Co., Chicago, Ill.

Socketing Wire Rope. 16 p. Union Wire Rope Corp., Tulsa, Okla.

Silverstreak Silent Chain Data Book. 96 p. Link-Belt Co., Chicago, Ill.

Speed-O-Matic Shovels, Cranes, Draglines. 12 p. Link-Belt Co., Chicago, Ill.

A Buyer's Guide to Mechanical Rubber Goods. 28 p. Diamond Rubber Co., Akron, O.

Patterson Agitating-Mixing Equipment. 72 p. Patterson Foundry & Machine Co., East Liverpool, O.

Plant Mixing Stabilized Aggregates with Calcium Chloride. Calcium Chloride Assn., Detroit, Mich.

Index of Manganese Steel Applications. 28 p. Manganese Steel Forge Co., Philadelphia, Pa.

Erie AggreMeter Plants. 8 p. Erie Steel Construction Co., Erie, Pa.

Plug Those Leaking Cylinders. 4 p. Heitzman Safety Blasting Plug Corp., Shamokin, Pa.

Union-C Air Compressors. 8 p. Union-C Machine Co., Union City, N. J.

Drill Without Dust. 4 p. Kadco Corp., New York, N. Y.

Sta-Tru Woven Wire Screens. 4 p. Ludlow-Saylor Wire Co., St. Louis, Mo.

Cutting Costs With Belt Conveyors. 6 p. Portable Machinery Co., York, Pa.

Road Stabilization Machinery for Plant and Pit. (Folders.) H. Brewer & Co., Tecumseh, Mich.

Universal Concrete Pipe. 92 p. Universal Concrete Pipe Co., Columbus, O.

Plat-O Screens stand close inspection

Absolute freedom from bearing troubles—not a single bearing failure or replacement, to our knowledge, in the last eight years due to ordinary wear and tear of regular operation. Bearings can be removed, for inspection, and replaced in housings in less than 30 minutes. This is one of the twelve points of superiority that makes the Plat-O Screen the best "buy" of the year—real profit-producing equipment.

1. **Extra rugged construction.**
2. **FREE FROM BEARING TROUBLE.**
3. **Adjustable vibration or throw.**
4. **High speed eliminates blinding.**
5. **Spring mounted, no vibration to supporting structure.**
6. **Oil lubrication, no grease.**
7. **Combined sifting and vibrating action for high capacity.**
8. **Ideal for medium or coarse screening.**
9. **Flat screening angle, minimum headroom.**
10. **Long screen cloth life, no whipping.**
11. **Screen cloths easily and quickly changed.**
12. **No eccentric, fewer bearings, fewer repairs.**

More about Plat-O next month, the Screen that is making sensational gains in sales. Ask for Bulletin No. 22 for full details.

DEISTER MACHINE CO.

1933 E. Wayne Street **Fort Wayne, Indiana**

Emil Deister, Sr., Pres.; I. F. Deister, V. Pres.

Emil Deister, Jr., Secy.-Treas.

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

Although every effort is made to insure accuracy and completeness in these listings, the publisher cannot accept responsibility for errors or omissions. Any mistakes discovered will gladly be rectified.

Index to Advertisers on Page 120

Aftercoolers (Air)
Worthington Pump & Machy. Corp.

Aggregate-Bituminizing Plants
Hetherington & Berner, Inc.
*Warren Brothers Roads Co.

Agitating Ladders (Dredge)
*Eagle Iron Works

Agitators, Thickeners and Slurry Mixers
*Hardinge Co.
Patterson Fdry. & Machine Co.
*Traylor Engr. & Mfg. Co.

Aggremeters
*Blaw-Knox Co.

Air Compressors (Portable)
*Fuller Co.
*Ingersoll-Rand Co.
*Traylor Engr. & Mfg. Co.
Worthington Pump & Machy. Corp.

Air Compressors (Stationary)
*Fuller Co.
*Ingersoll-Rand Co.
*Traylor Engr. & Mfg. Co.
Worthington Pump & Machy. Corp.

Air Filters
*Blaw-Knox Co.
*Western Precipitation Co.

Air Pumps
*Fuller Co.
*Ingersoll-Rand Co.
Worthington Pump & Machy. Corp.

Air Separators
Gay, Rubert M.
*Gruendler Crusher & Pulverizer Co.
*Hardinge Co.
Patterson Fdry. & Machine Co.
*Raymond Bros. Impact Pulv. Co.
Sturtevant Mill Co.
Universal Road Machy. Co.
*Williams Patent Crusher & Pulverizer Co.

Alloys (Steel)
American Manganese Steel Co.
Chain Belt Co.
Chicago Steel Foundry Co.
Manganese Steel Forge Co.
Taylor-Wharton Iron & Steel Co.

Arresters (Lightning)
*General Electric Co.

Ash and Refuse-Handling Equipment
*Allen-Sherman-Hoff Co.
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
Haiss Mfg. Co., Geo.
Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
*Link Belt Co.
*Robins Conveying Belt Co.

Asphalt Mixing Plants
Hetherington & Berner, Inc.
*Warren Brothers Roads Co.

Automatic Feeders
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
*Fuller Co.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Link Belt Co.
Patterson Fdry. & Machine Co.

Automatic Weighers
*Bartlett & Snow Co., C. O.
*Blaw-Knox Co.
*Fuller Co.
Merrick Scale Mfg. Co.

Backfillers
*Austin-Western Road Machy. Co.
*Bucyrus-Erie Co.
*Harnischfeger Corp.
Northwest Engr. Co.

Balls (Grinding)
*Bartlett & Snow Co., C. O.
Carnegie-Illinois Steel Corp.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Manganese Steel Forge Co.
Patterson Fdry. & Machine Co.
Taylor-Wharton Iron & Steel Co.

Balls (Tube-Mill, etc.)
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
Carnegie-Illinois Steel Corp.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Manganese Steel Forge Co.
Patterson Fdry. & Machine Co.

Baskets (Dipping)
Buffalo Wire Works Co.

Batteries
*General Electric Co.
Goodyear Tire & Rubber Co.

Bearings (Anti-Friction)
*Bartlett & Snow Co., C. O.
Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
Timken Roller Bearing Co.

Bearings (Roller)
Timken Roller Bearing Co.

Belt Drives
Chain Belt Co.

Belt Fasteners
Flexible Steel Lacing Co.

Belting
*Cincinnati Rubber Mfg. Co.
Goodyear Tire & Rubber Co.
Haiss Mfg. Co., Geo.
Hewitt Rubber Corp.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Republic Rubber Co.
*Robins Conveying Belt Co.
Welch Engr. Service, F. M.
*Wickwire Spencer Steel Co.

Belting (Multiple V)
Goodyear Tire & Rubber Co.
Republic Rubber Co.

Belting (Transmission)
Worthington Pump & Machy. Corp.

Belt Lacings
Flexible Steel Lacing Co.

Belts (Fan)
Goodyear Tire & Rubber Co.
Republic Rubber Co.

Bin Gates
*Allen-Sherman-Hoff Co.
*Bartlett & Snow Co., C. O.
Chain Belt Co.
*Fuller Co.
Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Manganese Steel Forge Co.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
Smith Engr. Works
*Traylor Engr. & Mfg. Co.
Universal Crusher Co.

Binks Manufacturing Equipment
Patterson Fdry. & Machine Co.

Bins (Cast Iron)
*Allen-Sherman-Hoff Co.

Bins (Steel)
*Austin-Western Road Machy. Co.
*Bartlett & Snow Co., C. O.
*Chicago Bridge & Iron Co.
*Hendrick Mfg. Co.
Hetherington & Berner, Inc.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Manganese Steel Forge Co.
McLanahan and Stone Corp.
Patterson Fdry. & Machine Co.
*Robins Conveying Belt Co.
Universal Crusher Co.

Blast-Hole Drills (See Drills—Blast-Hole)

Blasting Supplies
*Ensign-Bickford Co.

Block Machines (Concrete)
Dunn Mfg. Co.

Blocks (Pillow)
*Jeffrey Mfg. Co.

Blocks (Sheave)
American Manganese Steel Co.
Haiss Mfg. Co., Geo.
*Sauerman Bros., Inc.

Bodies (Motor Truck)
Hug Co.

Bodies (Motor Truck, Concrete Mixing)
*Bartlett & Snow Co., C. O.
*Blaw-Knox Co.
Chain Belt Co.
Jaeger Machine Co.

Boots (Rubber)
Goodyear Tire & Rubber Co.

Borings, Core
Hoffman Bros. Drilling Co.
Pennsylvania Drilling Co.

Blowers
Worthington Pump & Machy. Corp.

Breakers (Circuit)
*General Electric Co.

Breakers (Rock)
Atlantic Steel Co.

Brick Machines (Concrete)
Dunn Mfg. Co.

Brick Manufacturing Equipment
Dunn Mfg. Co.

Bronze Work (Ornamental)
Buffalo Wire Works.
National Wire Cloth Co.
*Tyler Co., W. S.

Buckets (Dump)
Dempster Bros., Inc.

Bucket Elevators (See Conveyors and Elevators)

Buckets (Clamshell, Orange-Peel, Etc.)
*Bartlett & Snow Co., C. O.
*Blaw-Knox Co.
Haiss Mfg. Co., Geo.
*Harnischfeger Corp.
*Link-Belt Co.
Owen Bucket Co.
Taylor-Wharton Iron & Steel Co.
Wellman Engr. Co.

Buckets (Dragline—Cableway)
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
*Bucyrus-Erie Co.
*Link-Belt Co.
*Page Engr. Co.
*Sauerman Bros., Inc.
Wellman Engr. Co.

Buckets (Elevator and Conveyor)
*Bartlett & Snow Co., C. O.
Chain Belt Co.
Cross Engr. Co.
Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
Smith Engr. Works

Buggies (Dump)
*Koehring Co.

Bulldozers
*Bucyrus-Erie Co.

Cableways
*Leschen & Sons Rope Co., A.
*Link-Belt Co.
*Page Engr. Co.
*Roebling's Sons Co., John A.
*Sauerman Bros., Inc.
*Wickwire Spencer Steel Co.

Calcium Chloride
Calcium Chloride Ass'n.

Capstans (See Winches and Capstans)

Car Dumpers
*Link-Belt Co.
Wellman Engr. Co.

Car Pullers
*Bartlett & Snow Co., C. O.
*Jeffrey Mfg. Co.
*Link-Belt Co.

Cars (Quarry and Gravel Pit)
*Austin-Western Road Machy. Co.

Carriers
*Bartlett & Snow Co., C. O.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
Smith Engr. Works
Welch Engr. Service, F. M.

Carryalls
*Koehring Co.

Car Wheels — (See Wheels — Car)

Castings
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
Chain Belt Co.
Chicago Steel Foundry Co.
*Eagle Iron Works
*Hardinge Co.
Hetherington & Berner, Inc.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
McLanahan and Stone Corp.
Patterson Fdry. & Machine Co.
*Robins Conveying Belt Co.
Taylor-Wharton Iron & Steel Co.

Cement Pumps (See Pumps; Air Pumps; Pumps, Cement Slurry; Pumps, Bulk Cement)

Central Concrete Mixing Plants (Comp.)
*Bartlett & Snow Co., C. O.

Chain Attachments
*Jeffrey Mfg. Co.

Chain (Dredge and Shovel)
Manganese Steel Forge Co.

Chain Drives
Chain Belt Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.

Chain (Elevating and Conveying)
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
Chain Belt Co.
Cross Engr. Co.
Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.
*Portable Machy. Corp.

Chute Lining (Rubber)
Goodyear Tire & Rubber Co.

Chutes and Chute Liners
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
Chain Belt Co.
Cross Engr. Co.
Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
McLanahan and Stone Corp.
Patterson Fdry. & Machine Co.
*Robins Conveying Belt Co.

Classifiers
*Deister Machine Co.
*Hardinge Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machine Co.
*Link-Belt Co.
Patterson Fdry. & Machine Co.
Simplicity Engr. Co.

Clips (Wire Rope)
*Leschen & Sons Rope Co., A.
*Roebling's Sons Co., John A.
*Wickwire Spencer Steel Co.

Clutches
*Jeffrey Mfg. Co.
*Link-Belt Co.

Coal-Pulverizing Equipment
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
Gay, Rubert M.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Patterson Fdry. & Machine Co.
*Raymond Bros. Impact Pulv. Co.
Universal Road Machy. Co.
*Williams Patent Crusher & Pulverizer Co.

Compressors (See Air Compressors)

Concentrators (Slurry)
*Deister Concentrator Co.

Concrete Breakers (Air)
*Ingersoll-Rand Co.
Worthington Pump & Machy. Corp.

Concrete Mixers
*Blaw-Knox Co.
Jaeger Machine Co.
*Koehring Co.

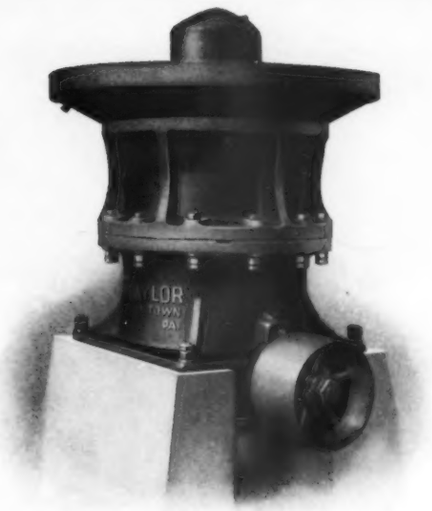
Concrete Slab-Raising Equipment (Mud-Jacks)
*Koehring Co.

Condensers
*Ingersoll-Rand Co.

Cones (Sand-Washing)
*Bartlett & Snow Co., C. O.
Iowa Mfg. Co.
*Link-Belt Co.
Smith Engr. Works

*See also information in the 1936 Pit and Quarry HANDBOOK.

TRAYLOR
TYPE TY REDUCTION CRUSHER



WE HAD a letter the other day from a recent purchaser in Mexico, of a 1' 8'' Traylor Type TY Reduction Crusher. He was full of praise for it, saying, among other things

> ''* * * I wish to congratulate you on the good design * * * the crusher just eats up the ore from the old fills.''

An old story to us, but a new delight and satisfaction to the purchaser of EVERY Type TY so far built, and they are many,—THAT'S the measure of greatness of this machine.

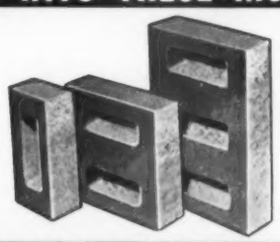
● *Full details are contained in Bulletin 105. Ask our office nearest you for a copy.*

TRAYLOR
ENGINEERING & MFG. CO.
Allentown, Pa.

NEW YORK CITY 3916 Empire State Bldg. | CHICAGO 2151 One La Salle St. Bldg. | SALT LAKE CITY 101 West Second South St.
LOS ANGELES 919 Chester William Bldg. | SEATTLE 6311 22nd Ave., N. E. | Timmins, Ontario, Canada P. O. Box 113
MANILA MACH. & SUPPLY CO. Manila and Baguio, P. I. | Robins Conveyors (So. Africa) Inc. Johannesburg, Transvaal, S. A.

Export Department—104 Pearl St., New York City
Foreign Sales Agencies: London, Lima, Sao Paulo, Rio de Janeiro, Buenos Aires, Santiago, Valparaiso, Antofagasta, Iquique, Oruro
European Works—Usines Carels Freres, Ghent, Belgium

YOUR SURPLUS AGGREGATE
MADE INTO THESE MODERN



BUILDING UNITS WILL BRING UP TO $12.00 PER TON

—— This machine will use 500 ton per month of your waste or surplus material and turn it into finished high-grade building material—This finished material DUNBRIK and DUNSTONE—the perfected all-purpose building units—supply the rapidly growing demand for modern, low cost construction. They sell readily and profitably wherever manufactured.

—— Why not put this machine to work like the Consolidated Rock Products Co., Brooksville, Fla.—F. A. Rider Sand & Gravel Co., Vestal, N. Y.—Riverside Sand & Gravel Co., Thiensville, Wis.—W. P. Rose, Goldsboro, N. C.—Consolidated Quarries of Georgia—Georgia Mineral Products Co., Tate, Ga.—Bayer-Brice Co., Flint, Mich.—and build up an independent, profitable manufacturing business.

—— Investigate. Learn how this machine and small crew will do the work of a large force and cost but a fraction of what would be required for other processes of equal capacity. Write today for "4 Keys to Success."

W. E. DUNN MFG. CO. - 420 W. 24th St. - Holland, Mich.

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

Index to Advertisers on Page 120

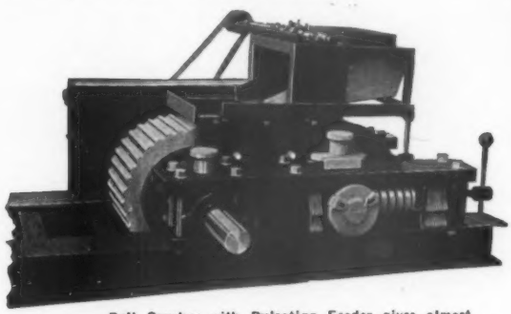
Controllers (Electric)
*General Electric Co.
Converters (Electric)
*General Electric Co.
Conveyor Belting (See Belting)
Conveyor Idlers and Rolls
*Bartlett & Snow Co., C. O.
Chain Belt Co.
Haiss Mfg. Co., Geo.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Portable Machy. Corp.
*Robins Conveying Belt Co.
Conveyors and Elevators
*Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
Bacon, Inc., Earle C.
*Bartlett & Snow Co., C. O.
Chain Belt Co.
Chicago Steel Foundry Co.
Cross Engr. Co.
*Fuller Co.
*Gruendler Crusher & Pulverizer Co.
Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
Industrial Brownhoist Corp.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
*Link-Belt Co.
McLanahan and Stone Corp.
New Holland Machine Co.
Patterson Fdry. & Machine Co.
*Portable Machy. Corp.
*Robins Conveying Belt Co.
Smith Engr. Works
Sturtevant Mill Co.
*Traylor Engr. & Mfg. Co.
Universal Road Machy. Co.
Welch Engr. Service, F. M.
Conveyors (Pneumatic)
*Fuller Co.
Conveyors (Ready-Mixed Concrete)
*Bartlett & Snow Co., C. O.
*Blaw-Knox Co.
Chain Belt Co.
Haiss Mfg. Co., Geo.
Jaeger Machine Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
Conveyors (Screw)
*Jeffrey Mfg. Co.
Conveyors (Vibrating)
*Jeffrey Mfg. Co.
Coolers (Clinker)
*Allis-Chalmers Mfg. Co.
Coolers (See Kilns and Coolers—Rotary)
Couplings (Flexible and Shaft)
Erie Pump & Engine Works
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
Couplings (Hose)
*Ingersoll-Rand Co.
Cranes (Crawler and Locomotive)
*Austin-Western Road Machy. Co.
*Bay City Shovels, Inc.
*Bucyrus-Erie Co.
*Harnischfeger Corp.
*Koehring Co.
*Link-Belt Co.
Northwest Engr. Co.
Cranes (Electric Traveling)
*Harnischfeger Corp.
Cranes (Overhead)
*Harnischfeger Corp.
Crusher Parts
American Manganese Steel Co.
*American Pulverizer Co.
*Bartlett & Snow Co., C. O.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
McLanahan and Stone Corp.
Taylor-Wharton Iron & Steel Co.
Crushers (Cone)
Nordberg Mfg. Co.
Crushers (Hammer)
*Allis-Chalmers Mfg. Co.
*American Pulverizer Co.
*Austin-Western Road Machy. Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
Carnegie-Illinois Steel Corp.
*Dixie Machy. Mfg. Co.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Sturtevant Mill Co.
*Williams Patent Crusher & Pulverizer Co.
Crushers (Jaw and Gyratory)
*Allis-Chalmers Mfg. Co.
*Austin-Western Road Machy. Co.
Bacon, Inc., Earle C.
*Bartlett & Snow Co., C. O.
*Gruendler Crusher & Pulverizer Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
New Holland Machine Co.
Nordberg Mfg. Co.
Smith Engr. Works
Toro Manufacturing Corp.
*Traylor Engr. & Mfg. Co.
Universal Road Machy. Co.
Crushers (Ring)
*American Pulverizer Co.
*Bartlett & Snow Co., C. O.
*Williams Patent Crusher & Pulverizer Co.
Crushers (Roll)
*Allis-Chalmers Mfg. Co.
*American Pulverizer Co.
*Austin-Western Road Machy. Co.
*Bartlett & Snow Co., C. O.
Bonnet Co.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
McLanahan and Stone Corp.
New Holland Machine Co.
Patterson Fdry. & Machine Co.
*Robins Conveying Belt Co.
Toro Manufacturing Corp.
*Williams Patent Crusher & Pulverizer Co.
Crushers (Rotary)
*Allis-Chalmers Mfg. Co.
*American Pulverizer Co.
*Austin-Western Road Machy. Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
New Holland Machine Co.
Toro Mfg. Corp.
*Williams Patent Crusher & Pulverizer Co.
Crushing Rolls
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
*Austin-Western Road Machy. Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
McLanahan and Stone Corp.
New Holland Machine Co.
Sturtevant Mill Co.
*Traylor Engr. & Mfg. Co.
*Williams Patent Crusher & Pulverizer Co.
Diesel Engines (See Engines—Diesel)
Dipper Parts
American Manganese Steel Co.
*Bucyrus-Erie Co.
Taylor-Wharton Iron & Steel Co.
Dippers and Teeth (Power Shovel)
American Manganese Steel Co.
*Bucyrus-Erie Co.
*Koehring Co.
Taylor-Wharton Iron & Steel Co.
Dragline Cableway Excavators
*Link-Belt Co.
*Page Engr. Co.
*Sauerman Bros., Inc.
Dragline Excavators
*Austin-Western Road Machy. Co.
*Bay City Shovels, Inc.
*Bucyrus-Erie Co.
*Harnischfeger Corp.
*Koehring Co.
*Link-Belt Co.
Northwest Engr. Co.
*Page Engr. Co.
Draglines (Walking)
*Bucyrus-Monighan Co.
Dredges
*Bucyrus-Erie Co.
Hetherington & Berner, Inc.
*Morris Machine Works
Welch Engr. Service, F. M.
Drilling Accessories
*Chicago Pneumatic Tool Co.
Cleveland Rock Drill Co.
Gardner-Denver Co.
*Ingersoll-Rand Co.
Worthington Pump & Machy. Corp.
Drill Bits
*Ingersoll-Rand Co.
Timken Roller Bearing Co.
Drilling Contractors
Hoffman Bros. Drilling Co.
Pennsylvania Drilling Co.
Drills (Blast-Hole)
*Bucyrus-Armstrong Co.
Cleveland Rock Drill Co.
*Ingersoll-Rand Co.
Worthington Pump & Machy. Corp.
Drills (Core)
Hoffman Bros. Drilling Co.
*Ingersoll-Rand Co.
Pennsylvania Drilling Co.
Drills (Diamond)
Hoffman Bros. Drilling Co.
Pennsylvania Drilling Co.
Drills (Hand-Hammer)
Cleveland Rock Drill Co.
*Ingersoll-Rand Co.
Drills (Rock)
*Bucyrus-Armstrong Co.
Cleveland Rock Drill Co.
*Ingersoll-Rand Co.
*Jeffrey Mfg. Co.
Drill Sharpening Machinery
*Ingersoll-Rand Co.
Drill Steel
Cleveland Rock Drill Co.
*Ingersoll-Rand Co.
Drills (Well) (See Drills—Blast-Hole)
Drives (Multiple, Belt, Chain, Rope)
*Allis-Chalmers Mfg. Co.
Chain Belt Co.
Worthington Pump & Machy. Corp.
Dryers
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
*Hardinge Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Fdry. & Mch. Co.
McLanahan and Stone Corp.
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.
Dust Arresters
*Bartlett & Snow Co., C. O.
*Blaw-Knox Co.
*Western Precipitation Corp.
Dust Collecting Systems
*Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
*Blaw-Knox Co.
Patterson Fdry. & Machine Co.
*Raymond Bros. Impact Pulv. Co.
*Western Precipitation Corp.
Dust Conveying Systems
*Allen-Sherman-Hoff Co.
*Bartlett & Snow Co., C. O.
*Blaw-Knox Co.
*Fuller Co.
*Western Precipitation Corp.
Dust Filters
*Western Precipitation Corp.
Dust Handling Systems (Hydro Vacuum)
*Allen-Sherman-Hoff Co.
Dynamite (See Explosives)
Electrical Equipment
*Allis-Chalmers Mfg. Co.
*General Electric Co.
I T E Circuit Breaker Co.
Electrodes (Welding)
Stulz-Sickles Co.
Elevator Belting (See Belting)
Elevators (See Conveyors and Elevators)
Eliminators (Soft Stone) (See Soft Stone Eliminators)
Welch Engr. Service, F. M.
Engineers
*Allis-Chalmers Mfg. Co.
Bacon, Inc., Earle C.
Bonnot Co.
Cross Engr. Co.
*Fuller Co.
Hetherington & Berner, Inc.
Iowa Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
McLanahan and Stone Corp.
Patterson Fdry. & Machine Co.
*Robins Conveying Belt Co.
Sturtevant Mill Co.
Welch Engr. Service, F. M.
Engine Generator Sets
See Generator Sets (Engine).
Engines (Diesel)
Caterpillar Tractor Co.
*Ingersoll-Rand Co.
Nordberg Mfg. Co.
*Page Engr. Co.
Worthington Pump & Machy. Corp.
Engines (Internal-Combustion)
Caterpillar Tractor Co.
*Ingersoll-Rand Co.
Nordberg Mfg. Co.
*Page Engr. Co.
Wilson, K. R.
Worthington Pump & Machy. Corp.
Engines (Steam)
*Ingersoll-Rand Co.
*Morris Machine Works
Nordberg Mfg. Co.
Excavating Machinery (See Shovels; Cranes; Buckets, etc.)
Excavators—Shallow Grading (Bucket Elevator Type)
Haiss Mfg. Co., Geo.
Fabricating (Electric Arc and Oxy-Acetylene)
Smith Co., S. Morgan
Stultz-Sickles Co.
United Welding Co.
Fans (Exhaust)
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Feeders
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
Chain Belt Co.
*Fuller Co.
*Hardinge Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Patterson Fdry. & Machine Co.
*Robins Conveying Belt Co.
Smith Engr. Works
Feed Water Heaters
Worthington Pump & Machy. Corp.
Fencing (Woven Wire)
Buffalo Wire Works Co.
Floor Sweeping Systems (Hydro Vacuum)
*Allen-Sherman-Hoff Co.
Fuses (Detonating)
*Ensign-Bickford Co.
Fuses (Electrical)
*General Electric Co.
Gaskets
*Cincinnati Rubber Mfg. Co.
Goodyear Tire & Rubber Co.
Hewitt Rubber Corp.
Republic Rubber Co.
Gasoline Engines (See Engines—Internal-Combustion)
Gas Producers
Wellman Engr. Co.
Gates (Bin) (See Bin Gates)
Gates (Clamshell)
Haiss Mfg. Co., Geo.
*Link-Belt Co.
Gears (Herringbone)
*Bartlett & Snow Co., C. O.
Chain Belt Co.
*General Electric Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Gears and Pinions
*Bartlett & Snow Co., C. O.
Chain Belt Co.
*General Electric Co.
Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Gelatin (See Explosives)
Generators (See Motors and Generators)
Generator Sets (Engine)
*General Electric Co.
Wilson, K. R.
Generator Sets (Motor)
*General Electric Co.
Wilson, K. R.

* See also information in the 1936 Pit and Quarry HANDBOOK.

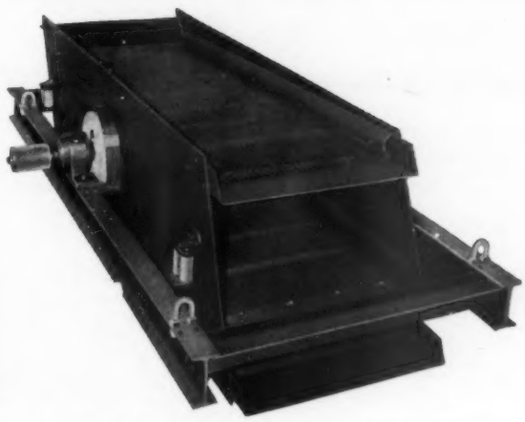
NEW HOLLAND

CRUSHERS

Start 1937 with the advantage of cost reducing equipment. The New Holland line of Screens, Crushers and Belt Conveyors is built for record low maintenance and maximum service under the most difficult conditions of operation. Write for Bulletin containing complete specifications.



Roll Crusher with Pulsating Feeder gives almost double the usual capacity. Rib shell construction increases angle of grip and reduces dust.



Vibrating Screen for Light or Heavy Duty built in standard sizes with one, two or three decks. Rubber cushioned cloth and bumpers. High grade bearings, fully enclosed and dust-tight.

SCREENS

NEW HOLLAND MACHINE CO.

P. O. Box No. 200 — New Holland, Penna.

EAGLE "SWINTEK"

SCREEN NOZZLE LADDER

Eliminates costly delays and irregular production due to suction line becoming clogged with boulders or debris from the deposit. Speed up production and incidentally *boost your profits* with the EAGLE "SWINTEK" NOZZLE LADDER. It insures an even flow of solids by loosening and agitating the deposit with a screen chain which also carries away everything that might otherwise clog the nozzle.

The EAGLE "SWINTEK" NOZZLE LADDER means CONTINUOUS OPERATION—GREATER OUTPUT—MORE PROFIT! Full information on request.

EAGLE IRON WORKS • DES MOINES, IOWA

FOR CLEAN SAND AND GRAVEL USE EAGLE WASHERS

SEND FOR EAGLE "SWINTEK" AND WASHER BULLETINS

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

Index to Advertisers on Page 120

Generator Sets (Turbine)
*General Electric Co.

Glass Sand Equipment
Lewistown Foundry & Machine Co.

Goggles
Cover, H. S.

Grab Buckets (See Buckets—Clamshell, Orange-Peel, etc.)

Grapples
Owen Bucket Co.

Grating (Steel)
*Bartlett & Snow Co., C. O.
*Blaw-Knox Co.
*Hendrick Mfg. Co.

Grinding Balls (See Balls, Grinding)

Grizzly Feeders
*Jeffrey Mfg. Co.

Grizzlies
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
*Eagle Iron Works
*Hendrick Mfg. Co.
Iowa Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Fdy. & Mach. Co.
Manganese Steel Forge Co.
*Robins Conveying Belt Co.
Smith Engr. Works
*Traylor Engr. & Mfg. Co.
Universal Road Machy. Co.

Guards (Wire)
*Bartlett & Snow Co., C. O.
Manganese Steel Forge Co.
National Wire Cloth Co.

Guns (Hydraulic)
Hetherington & Berner, Inc.
Taylor Forge & Pipe Works

Hammer Mills (See Crushers—Hammer)

Haulage Systems (Electric)
*General Electric Co.

Hoists
*Bartlett & Snow Co., C. O.
Hetherington & Berner, Inc.
*Ingersoll-Rand Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
McLanahan and Stone Corp.
*Sauerman Bros., Inc.
Smith Engr. Works

Hoppers
Chicago Bridge & Iron Co.
*Hendrick Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.

Hose (Air, Steam and Water)
*Cincinnati Rubber Mfg. Co.
Goodyear Tire & Rubber Co.
Hewitt Rubber Corp.
*Ingersoll-Rand Co.
Republic Rubber Co.
Worthington Pump & Machy. Corp.

Hose (Radiator-Engine Cooling)
Goodyear Tire & Rubber Co.
Republic Rubber Co.

Hose Couplings (See Couplings)

Hydraulic Guns (See Guns—Hydraulic)

Idlers
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
Chain Belt Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Portable Machy. Corp.
*Robins Conveying Belt Co.
Smith Engr. Works

Kilns and Coolers (Rotary)
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
*Chicago Bridge & Iron Co.
*Hardinge Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Patterson Fdry. & Machine Co.
*Traylor Engr. & Mfg. Co.

Kilns (Vertical)
*Chicago Bridge & Iron Co.
*Hardinge Co.

Lights (Flood)
*General Electric Co.

Lime-Handling Equipment
*Bartlett & Snow Co., C. O.
*Chicago Bridge & Iron Co.
*Fuller Co.
*Hardinge Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Raymond Bros Impact Pulv. Co.
*Robins Conveying Belt Co.

Lime and Hydrating Plants
*Chicago Bridge & Iron Co.
*Hardinge Co.

Lime Kilns
*Bartlett & Snow Co., C. O.
*Chicago Bridge & Iron Co.
*Hardinge Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.

Lime Putty Plants
*Chicago Bridge & Iron Co.

Linings (Ball- and Tube-Mill (See Mill Liners and Linings)

Loaders and Unloaders
*Bartlett & Snow Co., C. O.
*Fuller Co.
Haiss Mfg. Co., Geo.
Industrial Brownhoist Corp.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Patterson Fdry. & Machine Co.
*Portable Machy. Corp.
*Robins Conveying Belt Co.
Toro Mfg. Corp.

Locomotives (Diesel)
Whitcomb Locomotive Co.

Locomotives (Diesel-Electric)
*General Electric Co.
Whitcomb Locomotive Co.

Locomotives (Electric, Gas, Kerosene and Steam)
*General Electric Co.
Whitcomb Locomotive Co.

Locomotives (Gas Electric)
*General Electric Co.
Whitcomb Locomotive Co.

Locomotives (Oil Electric)
*General Electric Co.
Whitcomb Locomotive Co.

Locomotives (Storage Battery)
*General Electric Co.
*Jeffrey Mfg. Co.

Locomotives (Trolley-Battery)
*General Electric Co.
*Jeffrey Mfg. Co.

Magnetic Pulleys (See Pulleys, Magnetic)

Manganese Steel
American Manganese Steel Co.
Manganese Steel Forge Co.
Taylor-Wharton Iron & Steel Co.

Manganese Steel (Plates and Sheets)
American Manganese Steel Co.
Manganese Steel Forge Co.
Taylor-Wharton Iron & Steel Co.

Mask (Gas)
Cover, H. S.

Measuring Devices
*General Electric Co.

Mechanical Rubber Goods
*Cincinnati Rubber Mfg. Co.
Goodyear Tire & Rubber Co.
Hewitt Rubber Corp.
Republic Rubber Co.

Mill Liners and Linings
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
Carnegie-Illinois Steel Corp.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Patterson Fdry. & Machine Co.

Mills (Ball, Tube, etc.)
*Allis-Chalmers Mfg. Co.
*Hardinge Co.
Patterson Fdry. & Machine Co.

Mills (Grinding) (See also Crushers—Hammer)
*Allis-Chalmers Mfg. Co.
*American Pulverizer Co.
*Austin-Western Road Machy. Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
*Gruendler Crusher & Pulverizer Co.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Fdy. & Mch. Co.
Patterson Fdry. & Machine Co.
*Raymond Bros. Impact Pulv. Co.
Toro Mfg. Corp.
*Traylor Engr. & Mfg. Co.
*Williams Patent Crusher & Pulverizer Co.

Motors and Generators
*Allis-Chalmers Mfg. Co.
*General Electric Co.
*Harnischfeger Corp.
Wilson, K. R.

Motors (Internal-Combustion) (See Engines—Internal-Combustion)

Motor Trucks
General Motors Corp.

Netting (Locomotive Stack)
Buffalo Wire Works Co.
*Tyler Co., W. S.

Nozzles (Gravel Washing)
*Deister Concentrator Co.

Nozzles (Hydraulic) (See Guns—Hydraulic)

Nozzles (Spray)
*Deister Concentrator Co.

Packings
*Cincinnati Rubber Mfg. Co.
Goodyear Tire & Rubber Co.
Hewitt Rubber Corp.
Republic Rubber Co.

Partitions (Wire)
Buffalo Wire Works Co.
National Wire Cloth Co.

Paving Mixers
Jaeger Machine Co.
*Koehring Co.

Perforated Metal Plates
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
Chicago Perforating Co.
Cross Engr. Co.
*Hendrick Mfg. Co.
*Wickwire Spencer Steel Co.

Pipe, Dredge (Floating and Shore)
*Chicago Bridge & Iron Co.
Taylor Forge & Pipe Works
United Welding Co.

Pipe Flanges
Hetherington & Berner, Inc.
Taylor Forge & Pipe Works

Pipe Forms (Concrete)
Universal Concrete Pipe Co.

Pipe Machines (Concrete)
Universal Concrete Pipe Co.

Pipe (Welded)
Taylor Forge & Pipe Co.
United Welding Co.

Plants (Aggremeter) (See Aggremeter Plants)

Plug Valves (See Valves)

Pneumatic Conveying Systems (See Conveyors—Pneumatic)

Pneumatic Drills (See Drills, Rock)

Portable Conveyors
*Fuller Co.
Haiss Mfg. Co., Geo.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Portable Machy. Corp.
*Robins Conveying Belt Co.

Portable Crushing and Screening Plants
*Austin-Western Road Machy. Co.
*Bartlett & Snow Co., C. O.
*Gruendler Crusher & Pulverizer Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
Toro Mfg. Corp.
*Williams Patent Crusher & Pulverizer Co.

Portable Engines (See Engines—Internal Combustion)

Portable Loaders (See Loaders and Unloaders)

Power Shovels (See Shovels, Electric, Internal-Combustion and Steam)

Precipitators
*Western Precipitation Corp.

Proportioning Equipment
*Blaw-Knox Co.

Pulverized Fuel Systems
*Bartlett & Snow Co., C. O.
Gay, Rubert M.
*Hardinge Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Raymond Bros. Impact Pulv. Co.
Universal Road Machy. Co.

Pulverizers (See also Crushers; Mills; etc.)
*American Pulverizer Co.
*Austin-Western Road Machy. Co.
*Bartlett & Snow Co., C. O.
Bonnot Co.
*Gruendler Crusher & Pulverizer Co.
*Hardinge Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
New Holland Machine Co.
Patterson Fdry. & Machine Co.
*Raymond Bros. Impact Pulv. Co.
Sturtevant Mill Co.
Toro Mfg. Corp.
Traylor Engr. & Mfg. Co.
*Williams Patent Crusher & Pulverizer Co.

Pump Parts
Taylor-Wharton Iron & Steel Co.

Pump Valves (See Valves, Pump)

Pumps (Air-Lift)
*Fuller Co.
*Ingersoll-Rand Co.

Pumps (Bulk Cement)
*Fuller Co.

Pumps (Cement Slurry)
*Allen-Sherman-Hoff Co.
*Morris Machine Works

Pumps (Centrifugal)
*Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Chain Belt Co.
Erie Pump & Engine Works
Hetherington & Berner, Inc.
*Ingersoll-Rand Co.
Kansas City Hay Press Co.
*Morris Machine Works
Worthington Pump & Machy. Corp.

Pumps (Dredging)
*Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
*Bucyrus-Erie Co.
Erie Pump & Engine Works
Hetherington & Berner, Inc.
Kansas City Hay Press Co.
*Morris Machine Works
Worthington Pump & Machy. Corp.

Pumps (Sand and Gravel)
*Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Erie Pump & Engine Works
Hetherington & Berner, Inc.
*Ingersoll-Rand Co.
Kansas City Hay Press Co.
*Morris Machine Works

Pumps (Slip)
Patterson Fdry. & Machine Co.

Pumps (Vacuum)
*Fuller Co.

Ready-Mixed Concrete Plants
*Bartlett & Snow Co., C. O.

Respirators
Cover, H. S.

Rheostats
*General Electric Co.

Rock Breakers
Atlantic Steel Co.

Rock Drills (See Drills—Rock)

Rod Mills
*Hardinge Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Patterson Fdry. & Machine Co.
*Traylor Engr. & Mfg. Co.

Rods (Welding)
American Manganese Steel Co.
Stulz-Sickles Co.
Taylor-Wharton Iron & Steel Co.

Roofing (Steel)
Carnegie-Illinois Steel Corp.

Rope (Wire) (See Wire Rope)

Rubbish Burners
Cross Engr. Co.

Safety Equipment
Cover, H. S.

Sand and Gravel Handling Equipment
*Jeffrey Mfg. Co.
*Link-Belt Co.

Sand Separators
*Bartlett & Snow Co., C. O.
*Jeffrey Mfg. Co.
*Link-Belt Co.
McLanahan and Stone Corp.
Patterson Fdry. & Machine Co.
Simplicity Engr. Co.
Smith Engr. Works

Sand—Lime—Brick Machinery
*Hardinge Co.

Sand-Settling Tanks
*Bartlett & Snow Co., C. O.
*Chicago Bridge & Iron Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.

* See also information in the 1936 Pit and Quarry HANDBOOK.

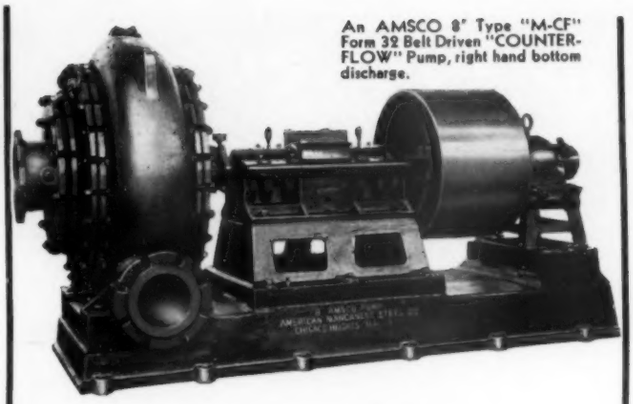
RELIANCE

Small, compact and inexpensive, the screening and washing plant pictured above is the ideal answer to the sand and gravel producer who must produce quality materials in relatively small quantities. These plants are supplied in two sizes—the smaller having a capacity of 30-40 tons per hour, the larger 40-70 tons per hour, depending on the nature of the material. The smaller plants are especially suited to produce materials in local demand. Small road jobs can also be undertaken provided the operator has time to accumulate stockpiles in advance of deliveries. The larger plant can easily handle a good sized road job with sufficient extra capacity to handle local work as well. The plant illustrated utilizes a self-cleaning bin, although any type of bin may be used.

Universal Road Machinery Co.

Kingston, N. Y.

COMPLETE CRUSHING, WASHING AND SCREENING EQUIPMENT FOR QUARRIES AND PITS . . CAPACITIES FROM 100 TO 1500 TONS PER DAY



An AMSCO 8" Type "M-CF" Form 32 Belt Driven "COUNTER-FLOW" Pump, right hand bottom discharge.

AMSCO

"COUNTERFLOW" DESIGN GREATLY INCREASES THE SERVICE LIFE!

Dredge and sand handling pumps of AMSCO "COUNTER-FLOW" design have a greatly increased service life because of two outstanding features: (1) Internal wear is minimized by "COUNTERFLOW" design, and (2) AMSCO Manganese Steel, "the toughest steel known," affords fullest impact and abrasion resistance.

"COUNTERFLOW" design advantages include: a wide funnel mouth impeller; threading of the impeller bore and shaft; minimized internal leakage; and greatly reduced internal wear which is accomplished by introducing clean water under pressure between the impeller shrouds and the shell side plates. The clear water, which is forced between the shrouds and plates with a counterflow action, excludes sand laden water, and definitely reduces the usual abrasive action.

"COUNTERFLOW" design is available in all new AMSCO Pumps, and for almost all types and sizes of AMSCO Pumps now in service which can be readily converted at nominal cost to take advantage of the savings that "COUNTERFLOW" design effects.

Send for a copy of the new AMSCO Pump Bulletin!

AMERICAN MANGANESE STEEL COMPANY

Division of American Brake Shoe & Foundry Company

396 East 14th Street, Chicago Heights, Ill.

Foundries at Chicago Heights, Ill., New Castle, Del., Denver, Colo.; Oakland, Calif.; Los Angeles, Cal. • Offices in Principal Cities

Dredge of the Des Moines Sand & Fuel Company fitted with an AMSCO 10" Type "H" "COUNTERFLOW" Pump and an Eagle Swintek Ladder.

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

Index to Advertisers on Page 120

Patterson Fdry. & Machine Co.
Smith Engr. Works
Welch Engr. Service, F. M.

Scales
Merrick Mfg. Co.

Scales (Track and Truck)
Merrick Mfg. Co.

Scrapers (Power Drag)
*Austin-Western Road Machy. Co.
Iowa Mfg. Co.
*Link-Belt Co.
*Sauerman Bros., Inc.

Screens
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Audubon Wire Cloth Corp.
Bacon, Inc., Earle C.
*Bartlett & Snow Co., C. O.
Buffalo Wire Works Co.
Carnegie-Illinois Steel Corp.
Chain Belt Co.
Chicago Perforating Co.
Cleveland Wire Cloth & Mfg. Co.
Cross Engr. Co.
*Deister Concentrator Co.
*Deister Machine Co.
*Eagle Iron Works
Gay, Rubert M.
*Gruendler Crusher & Pulverizer Co.
Haiss Mfg. Co., Geo.
*Hardinge Co.
*Hendrick Mfg. Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
*Link-Belt Co.
Ludlow-Saylor Wire Co.
Manganese Steel Forge Co.
McLanahan and Stone Corp.
National Wire Cloth Co.
Nordberg Mfg. Co.
*Portable Machy. Corp.
*Productive Equip. Corp.
*Roebling's Sons Co., John A.
*Robins Conveying Belt Co.
Simplicity Engr. Co.
Smith Engr. Works
Sturtevant Mill Co.
Symons Bros. Development Co.
Taylor-Wharton Iron & Steel Co.
Toro Mfg. Corp.
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.
Universal Road Machy. Co.
Welch Engr. Service, F. M.
*Wickwire Spencer Steel Co.

Screens (Vibrating or Shaking)
*Allis-Chalmers Mfg. Co.
*Austin-Western Road Machy. Co.
*Bartlett & Snow Co., C. O.
Buffalo Wire Works Co.
*Deister Concentrator Co.
*Deister Machine Co.
*Gruendler Crusher & Pulverizer Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
*Link-Belt Co.
McLanahan and Stone Corp.
New Holland Machine Co.
Nordberg Mfg. Co.
*Portable Machy. Corp.
*Productive Equip. Corp.
*Robins Conveying Belt Co.
Simplicity Engr. Co.
Smith Engr. Works
Sturtevant Mill Co.
Symons Bros. Development Co.
*Tyler Co., W. S.
*Williams Patent Crusher & Pulverizer Co.

Scrubbers
*Tyler Co., W. S.

Separators (Air) (See Air Separators)

Separators (Slurry)

Sheaves
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
Chain Belt Co.
*Eagle Iron Works
*Gruendler Crusher & Pulverizer Co.
Haiss Mfg. Co., Geo.
Hetherington & Berner, Inc.
*Link-Belt Co.
*Jeffrey Mfg. Co.
McLanahan and Stone Corp.

Shovels (Electric, Internal-Combustion and Steam)
*Austin-Western Road Machy. Co.
*Bay City Shovels, Inc.
*Bucyrus-Erie Co.
*Harnischfeger Corp.
*Koehring Co.
*Link-Belt Co.
Northwest Engr. Co.

Siding (Steel)
Carnegie-Illinois Steel Corp.

Silos
Chain Belt Co.
*Chicago Bridge & Iron Co.

Skip Hoists and Skips
*Allis Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
Chain Belt Co.
Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
Welch Engr. Service, F. M.

Sleeves Dredge
*Cincinnati Rubber Mfg. Co.

Speed Reduction Units
Chain Belt Co.
*General Electric Co.
Iowa Mfg. Co.
*Link-Belt Co.

Spouts (See Chutes and Chute Liners)

Sprays
*Deister Concentrator Co.

Sprockets and Chain
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
Chain Belt Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.

Stackers
*Jeffrey Mfg. Co.
United Welding Co.
Welch Engr. Service, F. M.

Stabilized Road Mix
Calcium Chloride Ass'n.

Starters (Automatic Motors)
*General Electric Co.

Steel (Alloy) (See Alloys—Steel)

Steel (Bars, Shapes, Plates, Etc.)
Carnegie-Illinois Steel Corp.

Steel Grating (See Grating, Steel)

Steel Plate Construction
Carnegie-Illinois Steel Corp.
Chicago Bridge & Iron Co.
Hetherington & Berner, Inc.
Manganese Steel Forge Co.
*Portable Machy. Corp.
Taylor-Wharton Iron & Steel Co.

Stone Grapples
Owen Bucket Co.

Storage Equipment
*Bartlett & Snow Co., C. O.
Chain Belt Co.
*Chicago Bridge & Iron Co.
Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Kern Co., Fred T.
*Link-Belt Co.
*Sauerman Bros., Inc.

Sweeping Systems
*Allen-Sherman-Hoff Co.

Switchboards (Electric)
*General Electric Co.

Switches (Electric)
*General Electric Co.
I T E Circuit Breaker Co.

Switches (Safety)
*General Electric Co.
I T E Circuit Breaker Co.

Tanks
*Bartlett & Snow Co., C. O.
*Chicago Bridge & Iron Co.
*Hendrick Mfg. Co.
*Link-Belt Co.
Patterson Fdry. & Machine Co.
*Portable Machy. Corp.
United Welding Co.

Tanks (Elevated Steel)
*Chicago Bridge & Iron Co.

Tanks (Sand-Settling)
*Bartlett & Snow Co., C. O.
*Chicago Bridge & Iron Co.
Iowa Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Patterson Fdry. & Machine Co.
Smith Engr. Works
Welch Engr. Service, F. M.

Testing Sieves and Shakers
*Hendrick Mfg. Co.
*Tyler Co., W. S.

Thawing Equipment
Aeroil Burner Co.

Thickeners (Slurry)
*Hardinge Co.
Patterson Fdry. & Machine Co.

Tire Repair Materials
Goodyear Tire & Rubber Co.

Tools (Drill) (See Drilling Accessories)

Torches (Thawing)
Aeroil Burner Co.

Track & Track Materials
Taylor-Wharton Iron & Steel Co.

Track Shifters
Nordberg Mfg. Co.

Tractors
*Allis-Chalmers Mfg. Co.
Caterpillar Tractor Co.

Trailers
General Motors Corp.
Hug Co.

Tramways (Aerial)
*Roebling's Sons Co., John A.

Transformers
*Allis-Chalmers Mfg. Co.
*General Electric Co.

Transmission Belting (See Belting)

Transmission Machinery
*Allis-Chalmers Mfg. Co.
American Manganese Steel Co.
*Bartlett & Snow Co., C. O.
Chain Belt Co.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.

Trippers
*Bartlett & Snow Co., C. O.
Chain Belt Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

Truck Cranes (See Cranes)

Trusk Mixers
*Bartlett & Snow Co., C. O.
*Blaw-Knox Co.
Chain Belt Co.
Jaeger Machine Co.

Trucks and Trailers (See Motor Trucks)

Tube-Mills (See Mills — Ball, Tube, etc.)

Tubes (For Tire Casings)
Goodyear Tire & Rubber Co.

Turbines
Smith Co., S. Morgan

Underground Loaders
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.

Unit Heaters
*General Electric Co.

Unloaders (Box Car)
*Bartlett & Snow Co., C. O.
Chain Belt Co.
*Fuller Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Portable Machy. Corp.

Valves (Air)
Worthington Pump & Machy. Corp.

Valves (Pump)
*Cincinnati Rubber Mfg. Co.
Taylor Forge & Pipe Works

Variable Speed Reducers or Transmissions
Chain Belt Co.
*Link-Belt Co.

Vibrating Screen Plate
*Bartlett & Snow Co., C. O.
Chicago Perforating Co.
Cross Engr. Co.
*Hendrick Mfg. Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.

Vibrating Screens (See Screens—Vibrating)

Vibrators
*Jeffrey Mfg. Co.
*Tyler Co., W. S.

Wagons (Dump)
*Koehring Co.

Washers (Sand, Gravel and Stone)
*Allis-Chalmers Mfg. Co.
*Bartlett & Snow Co., C. O.
*Eagle Iron Works
Haiss Mfg. Co., Geo.
*Hardinge Co.
Iowa Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Mach Co.
*Link-Belt Co.
McLanahan and Stone Corp
Patterson Fdry. & Machine Co.
Smith Engr. Works
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.
Universal Road Machy. Co.
Welch Engr. Service, F. M.

Weighing Equipment (Automatic)
*Blaw-Knox Co.
*Fuller Co.
Merrick Scale Mfg. Co.

Welding and Cutting Equipment
*General Electric Co.
Smith Company, S. Morgan
Stulz Sickles Co.

Welding Service
Stulz Sickles Co.
United Welding Co.

Welding Supplies
American Manganese Steel Co.
*American Steel & Wire Co.
*General Electric Co.
*Harnischfeger Corp.
Manganese Steel Forge Co.
*Roeblings Sons Co., John A.
Stulz Sickles Co.
Taylor-Wharton Iron & Steel Co.
United Welding Co.
*Wickwire Spencer Steel Co.

Well Drills (See Drills—Well)

Wheels (Car)
American Manganese Steel Co.
*Eagle Iron Works
Iowa Mfg. Co.

Wheel Rims. See Rims—Wheel

Winches and Capstans
Chain Belt Co.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

Wire and Cable (Electric)
*General Electric Co.
*Roebling's Sons Co., John A.

Wire Cloth
Audubon Wire Cloth Corp.
Buffalo Wire Works Co.
Cleveland Wire Cloth & Mfg Co.
Ludlow-Saylor Wire Co.
Manganese Steel Forge Co.
National Wire Cloth Co.
*Robins Conveying Belt Co.
*Roebling's Sons Co., John A.
Taylor-Wharton Iron & Steel Co.
Tyler Co., W. S.
*Wickwire Spencer Steel Co.

Wire Rope
American Cable Co.
Buffalo Wire Works Co.
*Leschen & Sons Rope Co., A.
Licensees under Preformed Wire Rope Patents
*Roebling's Sons Co., John A.
*Wickwire Spencer Steel Co.
*Williamsport Wire Rope Co.

Wire Rope Fittings
American Cable Co.
Buffalo Wire Works Co.
*Leschen & Sons Wire Rope Co., A.
Licensees under Preformed Wire Rope Patents
*Page Engr. Co.
*Roebling's Sons Co., John A.
*Wickwire Spencer Steel Co.
*Williamsport Wire Rope Co.

Wire Rope Slings
American Cable Co.
*Leschen & Sons Rope Co., A.
Licensees under Preformed Wire Rope Patents
*Wickwire Spencer Steel Co.
*Roebling's Sons Co., John A.
*Williamsport Wire Rope Co.

Wire (Welding)
American Manganese Steel Co.
Manganese Steel Forge Co.
*Roebling's Sons Co., John A.
*Wickwire Spencer Steel Co.

Worm Gears (See Gears and Pinions)

* See also information in the 1936 Pit and Quarry HANDBOOK.

Fine Screening by THE Leahy

ANOTHER SATISFIED USER OF THE CONCENCO LEAHY SCREEN

Specially designed for fine screening.

Built extra sturdy.

Read what they say:

"We use this screen at our plant for screening kiln sand. It has been in use for approximately two years, and has been very satisfactory."

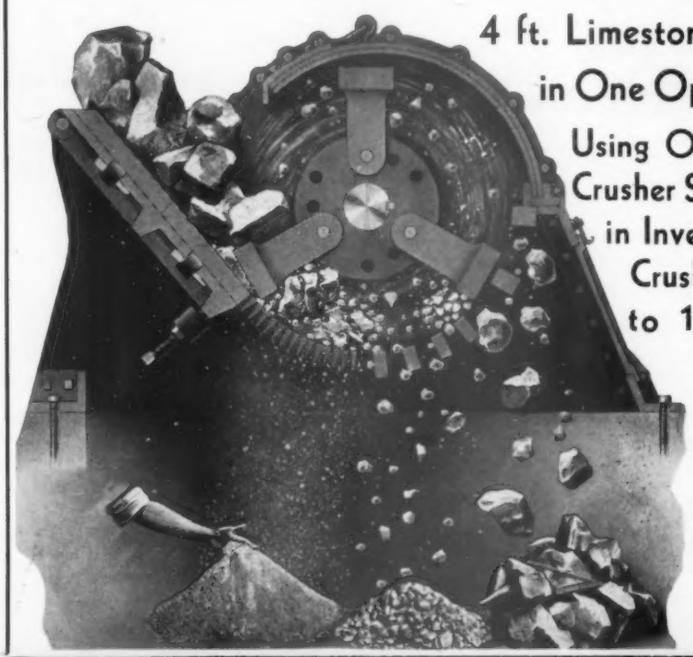
Yours very truly,

STANDARD CLAY PRODUCTS CO.
E. H. Pettler, General Mgr.

We also manufacture Sand Classifiers and the Deister Overstrom Diagonal Deck Washing Table for sand and gravel, which produces a premium product at minimum cost—handling from 18 to 40 tons per hour.

Write for Bulletin

THE ORIGINAL
DEISTER CONCENTRATOR COMPANY
Incorporated 1906
911 Glasgow Ave. Ft. Wayne, Ind.



4 ft. Limestone to 1¼ inch in One Operation . . . Using One Williams Crusher Saves 50% to 75% in Investment . . . Smaller sizes Crush "One Man" Size Stone to 1¼", ¾", or Agstone

Cover of the No. 7 "Mammoth" crusher. Special attention is directed to the large hopper opening.

The Williams "Mammoth" Crusher is the modern and economical way to crush rock. It takes hard limestone as large as 4 feet and reduces to 1¼" in one operation, taking the place of a primary breaker and recrusher and eliminating the conveyors and elevators for carrying the rock from one crusher to another. Saving in first cost is 50% to 75% and crushing costs are obviously less because of fewer operations.

Williams Patent Crusher & Pulverizer Co.
802 St. Louis Ave., St. Louis, Mo.
Sales Agencies in All Principal Cities Including
Chicago 37 W. Van Buren | New York 15 Park Row | San Francisco 326 Rialto Bldg.

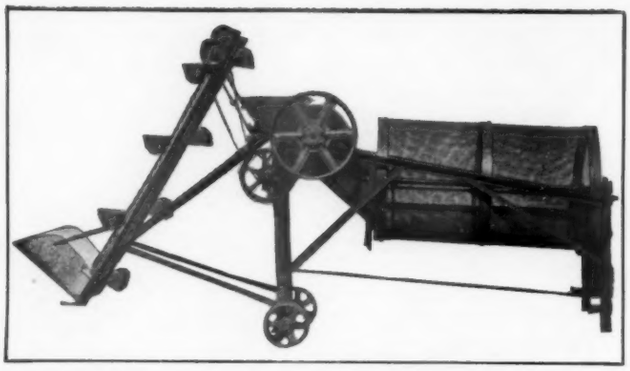
REG. U.S. PAT. OFF. THE TRADE MARK WILLIAMS PATENT CRUSHER & PULVERIZER CO. ST. LOUIS, MO. U.S.A.

Williams
OLDEST AND LARGEST BUILDERS OF HAMMERMILLS IN THE WORLD
PATENT CRUSHERS GRINDERS SHREDDERS

Hammer Crushers
Air Separators
Vibrating Screens
Impact Mills

TORO
GRINDER and SCREENER

A sturdily built and perfectly engineered machine that can be operated by any type motor of 4 H.P. or more, or by means of a belt pulley power take-off on a tractor. Furnished with a 36-inch screen in any size from 1/8" to 1/2".



GRINDS AND SCREENS IN ONE OPERATION

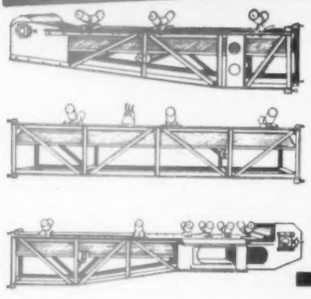
The sand and gravel trade is finding that this machine handles sand, gravel, and particularly molding sand, in a most efficient and economical way. Present users claim it is an indispensable aid to production.

WRITE FOR SPECIAL FOLDER

Grinder and Screener operating at loading point. ⟶

TORO MANUFACTURING CORPORATION
Minneapolis, Minnesota

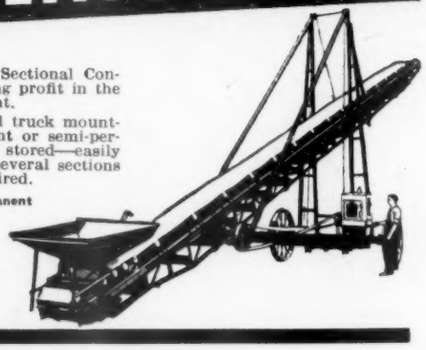
NEW WAYS TO CUT MATERIALS HANDLING COSTS



The flexibility and adaptability of the Porta "Model 347" Sectional Conveyor offers wide opportunities for cutting costs and increasing profit in the handling of crushed stone, aggregates, sand, gravel and cement.

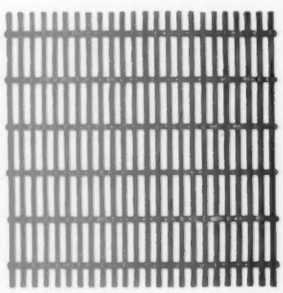
Made up of Independent Sections. . . . Can be used on wheel truck mounting, caster mounting, or mounted on supports as a permanent or semi-permanent installation. . . . Can be readily dis-assembled and stored—easily transported—easily re-assembled. . . . User may start with several sections and add additional sections, mountings and accessories as desired.

Our Catalog describes our complete line of Portable, Sectional and Permanent Conveyors designed to suit every Pit and Quarry requirement.



PORTABLE MACHINERY COMPANY
Division of A. B. Farquhar Co., Limited

CLIFTON, N. J. — Lakeview Ave.
Box C12 — YORK, PA.
CHICAGO, ILL. — 2549 N. Keeler Ave.



Rolled Slot

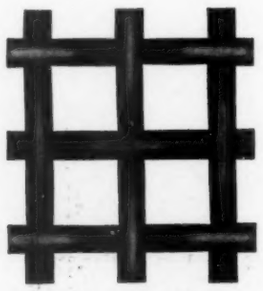
ALLOY No. 2

A super wearing Steel developed to resist the abrasion and vibration of modern screening demands.

"CLEVELAND" SCREENS

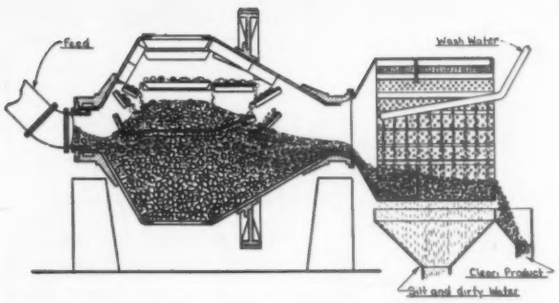
A wire cloth of guaranteed accuracy backed by fine workmanship and an effort to satisfy.

Available in Square Mesh and Rolled Slot. A trial will convince you of the superiority.



2 Mesh .162 Ga.

THE CLEVELAND WIRE CLOTH & MFG. COMPANY
574 E. 78th St. — **CLEVELAND, OHIO**



The Hardinge Conical Scrubber and Rinsing Trommel—Note the Great Depth of the Mass.

The WHY of the CONES *of the* Hardinge Conical Scrubber

The Cones raise the level of material and bring the center of the mass to the largest diameter, away from the feed and discharge openings during rotation—see cut above—this gives greater mass weight and consequent disintegration of soft material. This also permits larger trunnion openings.

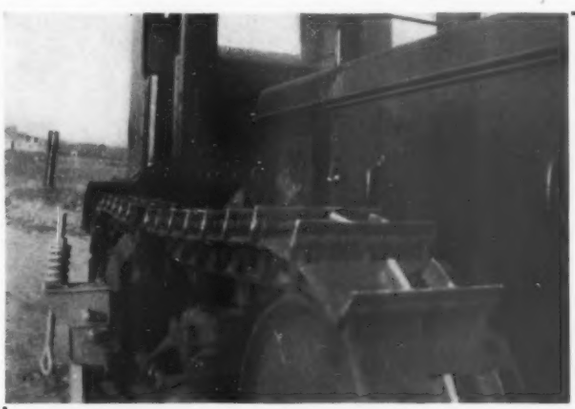
The Cones give a marked agitation of the mass, producing an intensive scrubbing action of harder particles against softer—this rubs clay balls to slime.

The Cones, which permit large trunnions, make it possible to use high shell speed—there are hundreds of more contacts of one particle against the other than is the case with cylindrical drums, trommel screens, logs, etc.

The Cones discharge the scrubbed product, without lifters—cutting power and reducing maintenance to a minimum. The Conical Scrubber will empty itself in a few minutes' operation without feed.

Installation View of Conical Scrubber Eliminating Soft Stone from Gravel and Rubbing Clay to Slime.

HARDINGE COMPANY
INCORPORATED
YORK, PENNA.—Main Office & Works
NEW YORK—122 E. 42nd St. CHICAGO—205 W. Wacker Drive
SAN FRANCISCO—501 Howard St. DENVER—817 17th St.



Worn down caterpillar tractor trend grousers reclaimed with special beveled section of MANGANAL Applicator Bars, attached with two beads of welding electrodes.

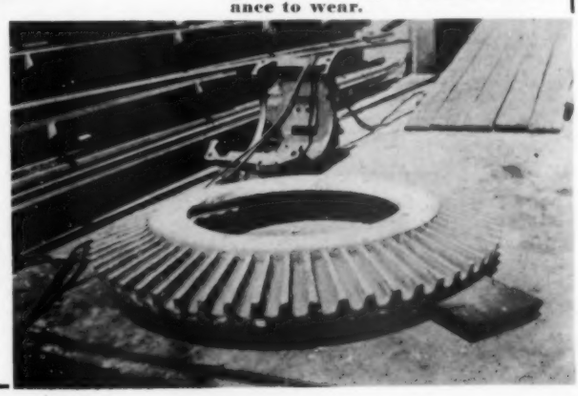
Industry's Modern Repair Material

MANGANAL

SEACO

Nickel Manganese Steel Reg. U. S. Patent Office Nos. 1,876,738; 1,947,167 and 2,021,945

Giant ring gear with worn portions rebuilt to normal size by welding with MANGANAL Welding Electrodes, thus changing carbon steel surface to manganese steel to increase resistance to wear.

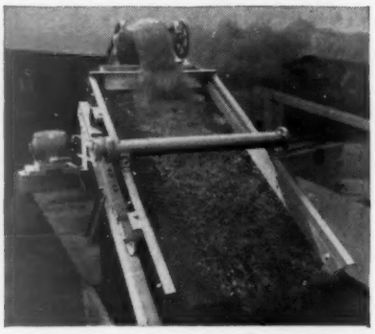


MANGANAL Applicator Bars are the ideal means of replacing metal—fast, economical and durable. SEACO Hard Surfacing Electrodes for overlay welding of Manganal 11% to 13½% nickel manganese steel and 11% to 14% Hadfield manganese steel, gives the final finish of extremely hard and tough wearing surface. Write for Bulletins.

STULZ-SICKLES CO., 91 N. J. Railroad Avenue
Newark, New Jersey

LINK-BELT *VIBRATING* SCREEN

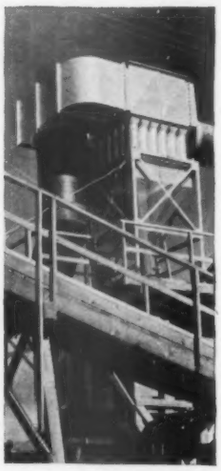
For Accurate Screening and Sizing



● All materials, fine or coarse, light or heavy... clay, gravel, sand, ores, crushed stone, coal, coke, fertilizer, grain, sugar, chemicals, pulpwood chips, etc....yield to the wizardry of the mechan'cal y-vibrated Link-Belt Vibrating Screen, and classify themselves in strict accordance with their size. Its uniform vibration keeps the meshes open, and makes the screen's entire screening surface 100% effective. Send for Book No. 1562.

Address Link-Belt Company, Philadelphia, Chicago, Indianapolis, Atlanta, San Francisco, Toronto, or any of our offices located in principal cities. 5905

Dust



Multiclones collect finer particles than any other type of centrifugal separator. Small tube construction gives effects hundreds of times stronger than gravity. There are no parts to clean, repair or replace. Multiclones are successfully used for cleaning hot or cold gases from kilns and furnaces, also for the collection of powders resulting from production processes. They are simple, compact and fireproof, and can be installed by ordinary factory labor. Unit construction permits any desired capacity and arrangement.

Send for Booklet.

WESTERN PRECIPITATION CORPORATION

1016 W. 9th St., Los Angeles, Calif. • 405 Lexington Ave., New York
Precipitation Co. of Canada, Ltd., Dominion Square Bldg., Montreal
COTTRELL ELECTRICAL PRECIPITATORS . . . PEEBLES SPRAY DRYERS
Specialists in Dust and Fume Control for more than a quarter century.

MULTICLONE

Accuracy **IS NECESSARY HERE:**

WEIGHTOMETERS FURNISH BETTER THAN 99.0% AFTER TEN YEARS' USE

Any material handled on a belt or pan conveyor fitted with a Merrick Conveyor Weightometer is automatically weighed and recorded as it moves along. The scale is always on the job giving honest accurate weight.

The Merrick Weightometer successfully weighs limestone, rock, cement, clinker, gypsum, shale and aggregate of all kinds. Write for details.

MERRICK SCALE MANUFACTURING CO.
186 Autumn Street, Passaic, New Jersey

MERRICK CONVEYOR WEIGHTOMETER

AAA **BIRMINGHAM**
ALABAMA

250 OUTSIDE ROOMS
250 BATHS with SHOWERS

RADIO IN EVERY ROOM

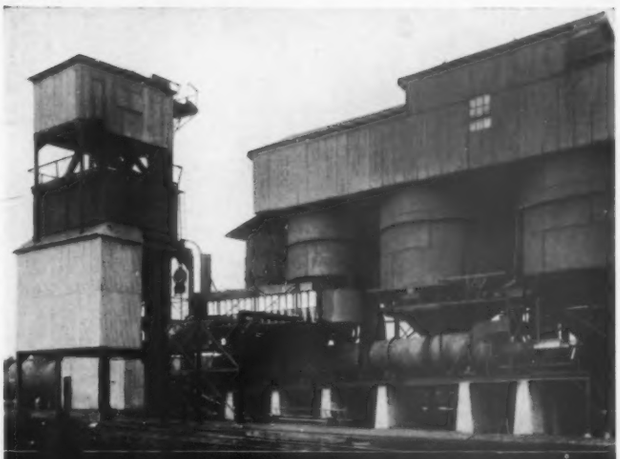
CIRCULATING ICE WATER IN EVERY ROOM

AIR CONDITIONED COFFEE SHOP

FRANK (PETE) WOODS, Manager
A. P. REICH, Managing Director

BIRMINGHAM'S MOST MODERN HOTEL

HOTEL REDMONT



WARREN ASPHALT PLANTS

HOT MIX —— COLD MIX

—— OR ——

COMBINATION UNIT FOR BOTH TYPES

CAPACITY DESIGN AND ARRANGEMENT
TO MEET
ANY REQUIREMENTS

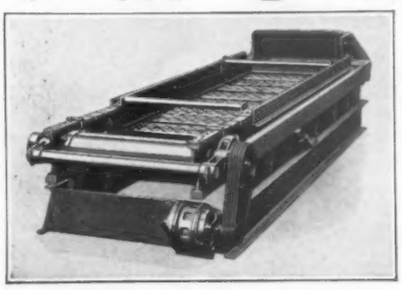
Designed and Built
—— By ——

WARREN BROTHERS ROADS CO.

P. O. BOX 1869

Boston Massachusetts

SYMONS SCREENS

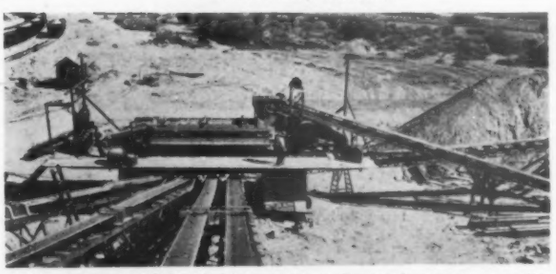


Sets level
Saves headroom
Greater capacity
Closer sizing
Automatic feed
Dust-tight bearings

Used on the World's largest projects including COULEE DAM, COLORADO RIVER AQUEDUCT, BOULDER DAM, T.V.A. and many others. Write for performance records.

Symons Bros. Development Co.

1462 N. Stanley Ave., Hollywood, California
and
Nordberg Manufacturing Company
Milwaukee, Wisconsin



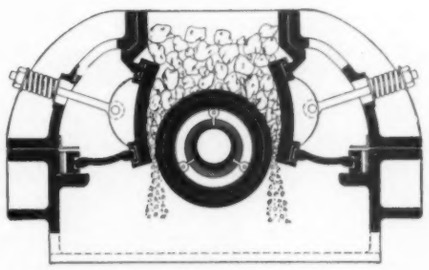
At Hawley plant of Colorado River Aqueduct, Symons Screens are separating 200 tons per hour into four graded sizes

---

—the "One Two"

"We believe you have a KNOCK-OUT in the line of crushers"

says a Texas operator



Manufactured under U. S. Patent No. 1946763

Two blows at every stroke, and no idle back-stroke, nor waste motion—that is why the Bonnot Crusher gives such record capacities of quality material at a minimum consumption of horse-power. Its speed of 750 blows per minute results in surprising tonnages for every size of Bonnot Crusher. Another feature, the *slow creep mantle* evenly distributes the wear, insuring vastly longer life and lower maintenance.

Write for Bulletin No. 160

THE BONNOT CO.

Manufacturers of Reduction Crushers, Hammer Mills, Pulverizers, Rotary Kilns, Disc Feeders, and Cement Mill Machinery.

— SINCE 1891 —

CANTON, OHIO

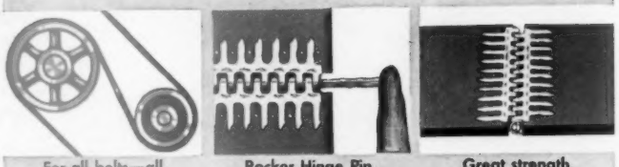
New York Office: 59 Church Street

ALLIGATOR

TRADE MARK REG. U.S. PAT. OFFICE

STEEL BELT LACING

The compression grip protects belt ends. | Made with precision. Drives straight. | Smooth on both faces. Embeds in belt.



For all belts—all speeds. Flexible. | Rocker Hinge Pin. Separable joint. | Great strength. Long life.

"Never Lets Go"

12 Sizes in Standard Boxes.

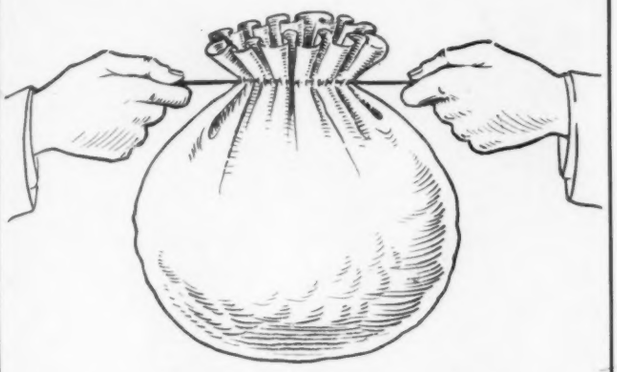
Made also in "Monel Metal" and non-magnetic alloy for special service, and in long lengths for wider belts.

Sole Manufacturers

FLEXIBLE STEEL LACING CO.

4623 Lexington Street Chicago, Illinois

In England at 135 Finsbury Pavement, London, E. C. 2



Tighten the Purse Strings with SIMPLICITY Screens

Why squander your profits on extravagant power costs, excessive operating expense and exorbitant maintenance, when you can avoid these losses by taking advantage of the many economy features built into SIMPLICITY Gyrating Screens! Fourteen years of continuous development have brought Simplicity Screens to their present-day efficiency. Write for descriptive folder.

SIMPLICITY ENGINEERING COMPANY

DURAND, MICHIGAN

PIT AND QUARRY

Research Department

538 South Clark St., Chicago, Ill.

Please send me catalogs and prices concerning the following items checked below:

- ☐ Agitators, sand and Gravel
- ☐ Agitators, Slurry
- ☐ Air cleaners
- ☐ Air compressors
- ☐ Bag filling and weighing machinery
- ☐ Bags, cloth
- ☐ Bags, paper
- ☐ Balls, steel
- ☐ Barges, steel
- ☐ Belt Dressing
- ☐ Belt fasteners
- ☐ Belting, conveyor and elevator
- ☐ Belting, transmission
- ☐ Belt lacing
- ☐ Belt plates
- ☐ Belt rivets
- ☐ Belt tighteners
- ☐ Bin gates
- ☐ Bins, concrete
- ☐ Bins, steel
- ☐ Blasting supplies
- ☐ Blasting powder
- ☐ Blocks, friction
- ☐ Boats, self-unloading
- ☐ Bodies, Motor Trucks
- ☐ Brake Linings
- ☐ Buckets, Clamshell
- ☐ Buckets, Conveyor and Elevator
- ☐ Buckets, Dragline
- ☐ Buckets, Orange Peel
- ☐ Cableways, Slackline
- ☐ Calcining Machinery
- ☐ Car Dumpers
- ☐ Car Pullers and Movers
- ☐ Carriers, Belt
- ☐ Cars, Dump
- ☐ Cars, Kiln
- ☐ Castings, Manganese Steel
- ☐ Castings, Steel
- ☐ Chains, Conveyor and Elevator
- ☐ Chains, Power Shovel, Crane and Dredge
- ☐ Chains, Transmission
- ☐ Chutes
- ☐ Classifiers
- ☐ Clips, Wire Rope
- ☐ Clutches
- ☐ Clutches, Magnetic
- ☐ Concrete Plants, Ready Mixed
- ☐ Cones, Washing
- ☐ Conveyors, Apron
- ☐ Conveyors, Belt
- ☐ Conveyors, Pneumatic
- ☐ Conveyors, Screw
- ☐ Conveyors, Skip
- ☐ Coolers
- ☐ Couplings, Flexible
- ☐ Couplings, Hose
- ☐ Cranes, Locomotive
- ☐ Cranes, Overhead Traveling
- ☐ Cranes, Truck
- ☐ Crushers, Cone
- ☐ Crushers, Disc
- ☐ Crushers, Gyratory
- ☐ Crushers, Hammer
- ☐ Crushers, Jaw
- ☐ Crushers, Ring
- ☐ Crushers, Roll
- ☐ Crushers, Rotary
- ☐ Cutter Heads, Dredging
- ☐ Derricks
- ☐ Draglines, Cableway
- ☐ Draglines, Revolving Boom
- ☐ Dredges, Dipper
- ☐ Dredges, Hydraulic
- ☐ Dredges, Ladder
- ☐ Drill Sharpening Machinery
- ☐ Drills, blast hole
- ☐ Drills, Diamond Core
- ☐ Drills, Hand Hammer
- ☐ Dryers, Rotary
- ☐ Dryers, Sand and Gravel
- ☐ Dust Collecting Systems
- ☐ Dynamite
- ☐ Elevators, Bucket
- ☐ Engines, Diesel
- ☐ Engines, Gas
- ☐ Engines, Gasoline
- ☐ Engines, Hoisting
- ☐ Engines, Oil
- ☐ Feeders
- ☐ Filters, Air
- ☐ Filters, Oil
- ☐ Fire Brick
- ☐ Flanges, Pipe
- ☐ Frogs and Switches
- ☐ Fuses, Blasting
- ☐ Gears
- ☐ Goggles
- ☐ Governors
- ☐ Grinding Balls
- ☐ Grizzlies
- ☐ Guns, Hydraulic
- ☐ Hoists, Air
- ☐ Hoists, Derrick
- ☐ Hoists, Drum
- ☐ Hoists, Motor Truck Body
- ☐ Hoists, Skip
- ☐ Hose, Air, Stream, Water
- ☐ Hose, Sand Suction
- ☐ Hydrators
- ☐ Kettles, Calcining
- ☐ Kilns, Rotary
- ☐ Kilns, Vertical
- ☐ Linings, Kiln
- ☐ Loaders, Portable
- ☐ Loaders and Unloaders Box Car
- ☐ Locomotives, Diesel
- ☐ Locomotives, Gasoline
- ☐ Locomotives, Steam
- ☐ Log Washers
- ☐ Measuring Devices
- ☐ Mills, Compartment
- ☐ Mills, Tube
- ☐ Mixers, Plaster
- ☐ Motors, Electric
- ☐ Motors, Gasoline
- ☐ Motor Trucks
- ☐ Motor Trucks, Ready-Mixed Concrete
- ☐ Nozzles, Hydraulic Mining
- ☐ Nozzles, Gravel Washing
- ☐ Nozzles, Spray
- ☐ Nozzles, Dust Settling
- ☐ Nozzles, Suction Hose
- ☐ Nuggets, Grinding Perforated Metal
- ☐ Poidometers
- ☐ Pulleys, Clutch
- ☐ Pulleys, Magnetic
- ☐ Pulverized Fuel Systems
- ☐ Pulverizers, Ball, Conical Pebble
- ☐ Pulverizers, Disc
- ☐ Pulverizers, Hammer
- ☐ Pulverizers, Ring
- ☐ Pulverizers, Rod
- ☐ Pulverizers, Roll
- ☐ Pumps, Centrifugal
- ☐ Pumps, Deep Well
- ☐ Pumps, Sand and Gravel
- ☐ Pumps, Slurry
- ☐ Pumps, Steam
- ☐ Radiators, Engine Cooling
- ☐ Rails
- ☐ Refractories
- ☐ Respirators
- ☐ Rollers, Conveyor
- ☐ Rolls, Crushing
- ☐ Rope, Wire
- ☐ Safety Appliances
- ☐ Sand-Lime-Brick Machinery
- ☐ Scales, Track
- ☐ Scales, Truck
- ☐ Scrapers, Dragline
- ☐ Screens, Revolving
- ☐ Screens, Shaking
- ☐ Screens, Vibrating
- ☐ Separators, Air
- ☐ Separators, Dry Centrifugal
- ☐ Separators Magnetic
- ☐ Shovels, Gasoline
- ☐ Shovels, Steam
- ☐ Skips
- ☐ Sleeves, Dredge
- ☐ Slugs and Nuggets, Grinding
- ☐ Speed Reducers and Gears
- ☐ Spray Nozzles
- ☐ Sprays, Paint
- ☐ Sprockets
- ☐ Steel, Tool
- ☐ Stokers
- ☐ Switches, Track
- ☐ Tanks, Concrete and Steel
- ☐ Tanks, Sand Settling
- ☐ Tanks, Wood
- ☐ Thickeners, Slurry
- ☐ Track, Portable
- ☐ Track Shifters
- ☐ Tractors, Crawler
- ☐ Tramways, Aerial
- ☐ Trippers, Belt
- ☐ Trippers, Tramway
- ☐ Unloaders
- ☐ Valves, Pump
- ☐ Washers and Scrubbers, Sand, Gravel, Stone
- ☐ Weighers, Automatic
- ☐ Welding Supplies
- ☐ Wheels, Car
- ☐ Winches
- ☐ Wire Cloth
- ☐ Wire Cloth, Manganese Steel

To be used for .....

Firm Name ..... *Individual* .....

Address ..... *City* ..... *State* .....

HYDROSEAL

MAXIMIX RUBBER PROTECTION

DREDGE PUMPS

See our advertisement on Inside Front Cover of Last Month's Issue

The ALLEN-SHERMAN-HOFF CO.
223 S. 15th Street — Philadelphia

HEAVY DUTY

DRYERS

Rotary Type

SINGLE UNITS OR COMPLETE WITH ACCESSORY BINS, CHUTES, FEEDERS, CONVEYORS, ELEVATORS, SCREENS, CRUSHERS AND OTHER EQUIPMENT AS DESIRED

ASK WHAT WE HAVE DONE FOR OTHERS

The C. O. BARTLETT & SNOW Co.
6197 Harvard Avenue • • Cleveland, Ohio

WILLIAMS

POWER-ARM, POWER-WHEEL, MULTIPLE-ROPE, DRAGLINE ..... *buckets*

FOR PAYLOADS THAT ARE PAYLOADS!

Your crane's earth moving capacity is no greater than that of the bucket you use. Order a Williams bucket and SEE a real digging demon in action. **Write for bulletins.**

THE WELLMAN ENGINEERING CO
7014 Central Ave., Cleveland, Ohio

SCREENS

Robins offers two distinct types of screens . . . GYREX and VIBREX . . . in more than three hundred styles and models. You save money and do better work when the screen fits the job. Ask the Robins Engineer to help you select the proper screen.

ALSO BELT CONVEYORS GATES FEEDERS

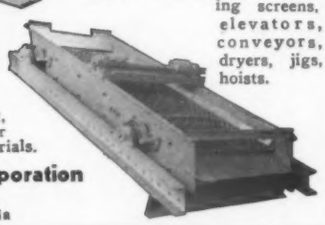
MATERIAL HANDLING ROBINS EQUIPMENT

Robins Conveying Belt Co.
15 Park Row New York, N. Y.
Send for Bulletins of interest.

McLANAHAN EQUIPMENT

CRUSHERS

Single and double roll and jaw crushers, hammer mills, super dry pans, — steel log washers and scrubbers, sand drags, revolving and vibrating screens, elevators, conveyors, dryers, jigs, hoists.



SCREENS

Complete portable, semi-portable and stationary crushing, screening and washing plants for different capacities of any materials.

McLanahan & Stone Corporation
Established 1835
Hollidaysburg, Pennsylvania

ROL-MAN

Rol-Man Rolled, True (11% to 14%) Manganese Steel has practically double the strength and abrasion resistance of cast manganese steel, ten times the "effective strength" of mild steel and three and a half times that of heat treated nickel steel. Send for this 32 page catalog No. 3R. No obligation.

MANGANESE STEEL FORGE CO. • Castor Ave. & Allen St. • PHILADELPHIA

SAUERMAN

LONG RANGE MACHINES

FOR DIGGING, CONVEYING, STORING, RECLAIMING

Sauerman Slacklines and Drag Scrapers dig and haul any distance up to 1,500 ft. at lowest cost per ton.

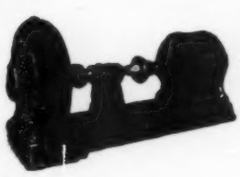
There is a type of Sauerman machine for under-water excavation, another for digging from a bank, another for stock-piling and reclaiming, and so on. Handling capacities range from 10 to 1,000 tons per hour.

Write for new 84-page catalog.

SAUERMAN BROS., 434 S. Clinton St., Chicago

ERIE SAND PUMPS

EFFICIENCY



ECONOMY

Their record of 48 years of satisfaction under the hardest conditions of pumping service outweighs all arguments. You can rely on ERIE Pumps for the profitable production of sand and gravel. Start your next dredging job with the advantages that go with ERIE Pumps.

Send for Catalog

ERIE PUMP & ENGINE WORKS
153 GLENWOOD AVE. MEDINA, N. Y.

MORRIS

CENTRIFUGAL PUMPS
•
DREDGES
•
STEAM ENGINES

For abrasive mixtures, corrosive liquids, or clear water. Any capacity, head, or method of drive.

For sand and gravel production, water supply reservoirs, filling in, or waterways improvements.

Vertical reciprocating type, single- and double cylinders, compound and triple expansion, 3 to 1000 hp.

Write for Bulletins

MORRIS MACHINE WORKS
Baldwinsville, N. Y.

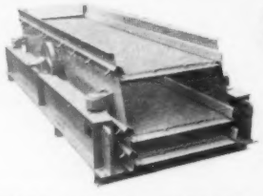
ROUND
SQUARE
SQUAROUND*
HEXAGON
PERFORATED PLATE
of every description
for maximum productiveness from your vibrating screens.
*Reg. U.S.Pat. Off.

HENDRICK MANUFACTURING CO.
39 Dundaff Street, Carbondale, Pa.
Sales Offices in Principal Cities. Please Consult Telephone Directory

TYLER SCREENS

CIRCLE-THROW MECHANICALLY AND ELECTRICALLY-VIBRATED

TON-CAP



and Woven Wire Screen
In all Meshes and Metals

Scrubbers and Dryers

THE W. S. TYLER COMPANY
3623 Superior Avenue Cleveland, Ohio

Lewistown Foundry Products
ARE
Performance-Tested

BUCKET ELEVATORS
REVOLVING SCREENS
CRUSHERS DRY PANS

Lewistown Foundry & Machine Co.
Lewistown, Pa.

TO MEN WHO WANT TO REDUCE HANDLING COSTS

You can make a substantial saving in the cost of handling stone or aggregate from quarry face to crusher with the Dempster-Dumpster — sometimes as much as 50%.

The Dumpster is furnished complete and can be mounted on any make or model of truck chassis. Units can be furnished to handle ¾-cu.yd. buckets to 1½-cu.yd. buckets and larger. Write for complete description and prices.

DEMPSTER BROS., INC.
Knoxville, Tennessee

DEMPSTER DUMPSTER

Only the SELECTRO by JIGGER
GIVES YOU A VIBRATING SCREEN WITH—

1. Selective Vibration, Throw
2. Full Tilting
3. Full Circle Throw
4. Oil—Not Grease—Lubrication
5. Ruggedness, Low Operating Costs

Send for new data book on screening

Write for More Information

PRODUCTIVE EQUIPMENT CORP.
4600 S. Kedzie Ave. Chicago, Ill.

KERN RADIAL STORAGE SYSTEMS

FOR

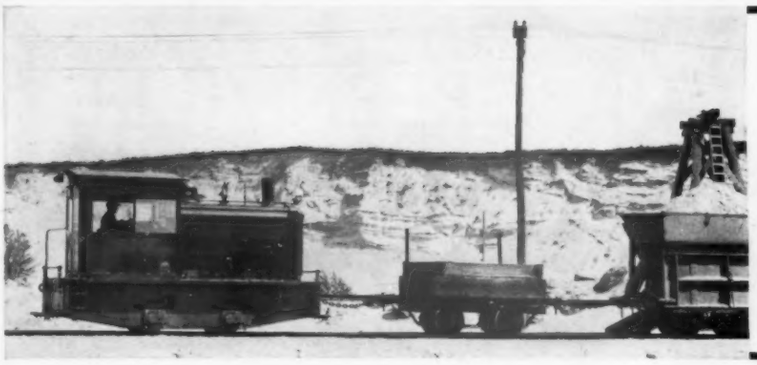
ECONOMICAL PRODUCTION AND STORAGE OF STONE, SAND AND GRAVEL.

COMPLETE PLANTS DESIGNED, ENGINEERED AND ERECTED TO MEET DEMANDS FOR BETTER MATERIALS AT LOWER COSTS

BOX 2057 FRED T. KERN CO. MILWAUKEE

In Philadelphia it's the

HOTEL PHILADELPHIAN
FORMERLY HOTEL PENNSYLVANIA
600 ROOMS WITH BATH FROM $2.50 UP
39th and CHESTNUT STREETS
PHILADELPHIA, PENNA.



Sold ON SAVINGS IN HAULAGE COSTS

• Bigger profits through extra economy is what sells Whitcomb Locomotives. Let us survey your haulage problem and show you what a Whitcomb internal combustion, or electric Locomotive will save over and above any other equipment.

No time lost getting up steam, cleaning fires, handling coal—no standby fuel losses. Whitcomb Locomotives are high-efficiency equipment—long life equipment with low up-keep cost. They provide smooth, rapid, quiet, safe service, and comfortable, one-man operation. The cross equalizer keeps locomotive in balance over rough track. High clearance—low center of gravity.

Countless industries use them in hauling and switching operations. Let us show you why they chose Whitcombs. Write for free survey of your haulage problem.

A Type to Suit Your Needs

Gasoline or Diesel Mechanical Drive	Electric Storage Battery
Gasoline or Diesel Electric Drive	Electric Trolley
	Combination Trolley-Storage Battery

WHITCOMB LOCOMOTIVES

THE WHITCOMB LOCOMOTIVE CO.

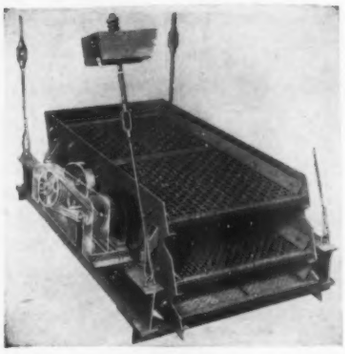
Subsidiary of The Baldwin Locomotive Works. Plant at Rochelle, Illinois. All sales made by The Baldwin Locomotive Works

Paschall Station Post Office, PHILADELPHIA, PA.

MODERNIZE WITH KENNEDY PRODUCTS

REDUCE YOUR POWER & MAINTENANCE
INCREASE YOUR PRODUCTION & PROFITS

BALL BEARING GEARLESS GYRATORY CRUSHERS
JAW CRUSHERS — VIBRATING SCREENS
CONVEYORS - ELEVATORS - DRYERS - MILLS, ETC.

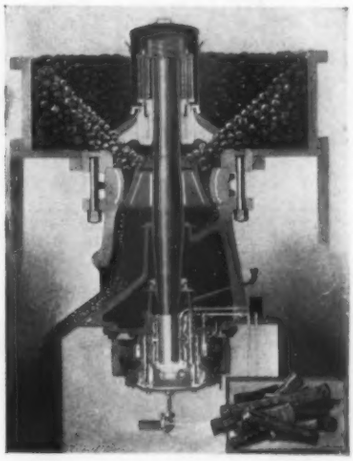


Vibrating Screen

COMPLETE PLANTS
To Suit ANY REQUIREMENTS

GET OUR RECOMMENDATIONS

WRITE FOR ONE OF OUR ENGINEERS TO CALL



Secondary Gearless Gyratory Crusher

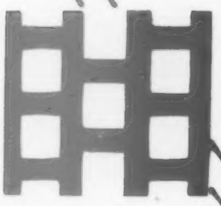
KENNEDY-VAN SAUN MFG. & ENG. CORP.

2 Park Avenue New York, N. Y.

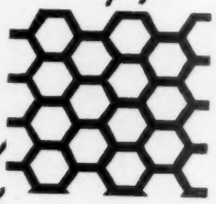
Sales Agents in all Principal Cities of the United States

PERFORATED PLATES

for ROTARY CONICAL VIBRATING and Other Types of Screens



SQUARE HOLES for Capacity



HEXCREEN the Ideal Type

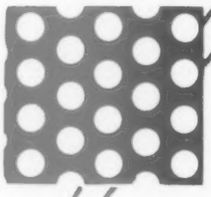
CROSS CROSS

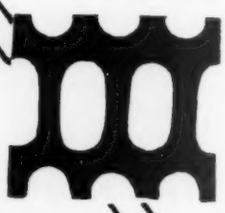
Proven Quality

Prompt Service

ROUND HOLES Uniform Sizing

SLOTTED HOLES Special Conditions



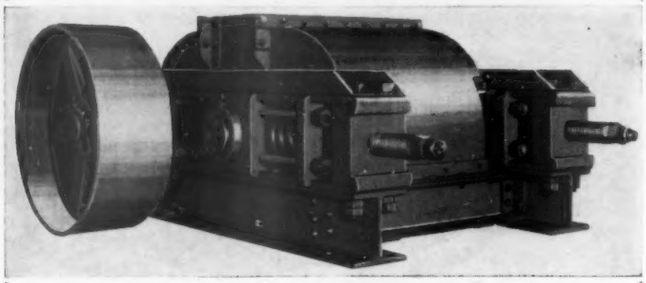


Write for Bulletins

CROSS ENGINEERING CO.
Main Office and Mfg. Plant
CARBONDALE, PENNA.

GREENVILLE ROLL CRUSHERS

DESIGNED ALONG SOUND, PRACTICAL ENGINEERING PRINCIPLES
WITH OR WITHOUT FEEDERS



COMPACT, POWERFUL, DOUBLE ROLL CRUSHERS
MADE IN ALL SIZES
CORRUGATED OR PLAIN
TO MEET ALL CONDITIONS

Convert your SURPLUS SIZES of gravel or crushed stone into MARKETABLE MATERIAL

Write your requirements to the

F. M. WELCH ENGINEERING SERVICE
GREENVILLE, OHIO

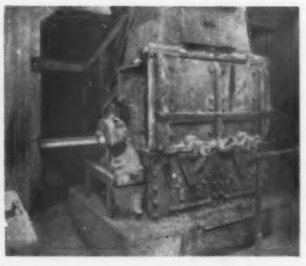
CINCINNATI

CONVEYOR BELTS · · CARRY *Big Tonnage*

THE CINCINNATI RUBBER MFG. CO.
CINCINNATI, OHIO

Pulverizers and Crushers

for Large or Small Capacities



Jeffrey builds Reduction Units in a large number of sizes for handling either large or small capacities, with machines of medium weight for light work and extra heavily constructed machines for the heavy work.

Nearly every plant has something to reduce—it makes no difference what it is—so when you next think of reduction — think of Jeffrey.

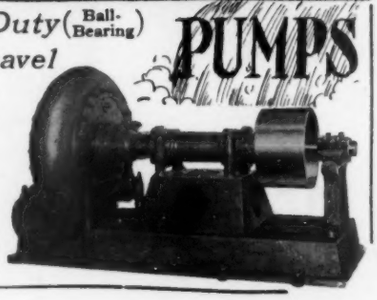
Catalog No. 550-G

The Jeffrey Manufacturing Co.
917-99 N. Fourth St., Columbus, Ohio

LIGHTNING

Heavy-Duty (Ball-Bearing) Sand and Gravel PUMPS

High efficiency — low operating cost—precision workmanship — wear-resisting, non-heating bearings even when operated under extremely high heads. WRITE



KANSAS CITY HAY PRESS CO.
KANSAS CITY. . . . MO.

STA-TRU

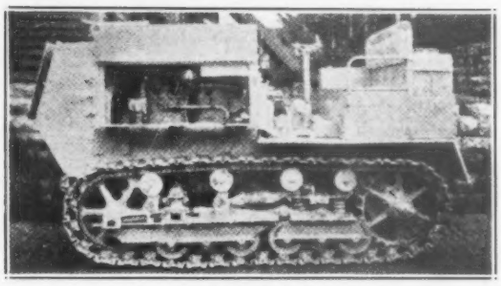
LONG - MESH
WOVEN WIRE SCREENS

LUDLOW-SAYLOR
WIRE CO. ST. LOUIS

JUST PURCHASED

FROM

U. S. GOVERNMENT — SLIGHTLY USED



5-TON HOLT CATERPILLAR TRACTORS

▼ ▼ ▼

(Offered While Supply Lasts)

Guaranteed Good Operating Condition **$395.00**

Industrial Machinery Company

EQUIPMENT DIVISION

2100-2300 Fletcher Avenue **Indianapolis, Indiana**

Drexel 3300

Several Hundred Other Pieces of Equipment—Write

CONSOLIDATED GOOD USED EQUIPMENT

4—Raymond Roller Mills—3 and 5-roll, high side; 5-roll, low side.
6—Raymond Pulverizers, No. 0000, 00, 1, 3.
8—Raymond Imp. Mills—No. 3, 45, 50, 55.
6—Hardinge iron lined Ball Mills, 3'x8", 4½'x16", 6'x22"; also other sizes.
1—6'x22" Hardinge silex lined Pebble Mill.
1—10' Sturtevant Air Classifier.
2—Gayco Air Separators, 30", 10'.
6—Tyler Hummer Screens, 3x5, 4x5.
4—3'x6' Sturtevant MV Screens, 2-deck.
1—5'x8' Niagara, 2-deck.
1—No. 32 Marcy Ball Mill.
1—No. 2 Sturtevant Ring Roll Mill.
5—6'x22' silex lined Tube Mills.
2—5'x22' silex lined Tube Mills.
1—3'x12' Hendy iron lined Tube Mill.

2—5x26', 5x30', 70"x35', double shell Ruggles-Coles Dryers.
12—Direct heat Rotary Dryers, 3x30, 4x30, 5x50, 5x60, 6x60.
3—8'x60' Ruggles-Coles single shell Rotary Dryers.
2—P. & M. 8'6" and 9'6"x150' Rotary Kilns.
1—8'x125' P. & M. Rotary Kiln.
2—8'x110' Bonnot Rotary Kilns.
1—6'x60' Bonnot Rotary Kiln, with seals, cooler, hood, etc.

12—Jaw Crushers—No. 1436 Cedar Rapids; No. 1536 Universal; 18x24 Reliance; 24x36 Farrell, Buchanan; 36x42 Traylor, Farrell; 42x60 Farrell; 48x60 Allis-Chalmers; 48x72" Buchanan.
1—7x24" Sturtevant Jaw Crusher, all steel.
1—18"x18" Penna. S. R. Crusher.
1—24"x24" Jeffrey single roll Crusher.
1—18x36" McLanahan-Stone single roll Crusher, Texrope drive, 25 H.P. 3/60/440 motor.
1—36" Superior McCully Gyratory—all other sizes and types.
2—36x16, 20x14" Sturtevant Crushing Rolls; also other sizes, types.
1—24x20" Jeffrey type B Hammer Mill.
1—36"x36" Gruendler Hammer Mill, roller bearings.
2—6x12' Hardinge Iron Lined Rod Mills.

Just a partial list.

WE WILL BUY A SINGLE MACHINE OR COMPLETE PLANT.

What do you wish to sell? Send us details.

Consolidated Products Company, Inc.

15-16-17 Park Row **New York, N. Y.**

Plant and Shops at Newark, N. J., cover 8 acres of ground.

FOR SALE

AMERICAN 70 ton 6-wheel switching locomotive with separate tender, 20x26" cylinders.
AMERICAN 50 ton 4-wheel saddle tank locomotive, 16x24" cylinders.
AMERICAN 40 ton 4-wheel saddle tank locomotives, 14x22" cylinders, six duplicates.
AMERICAN 30 ton 4-wheel saddle tank locomotive, 12x18" cylinders.
BALDWIN 75 ton 6-wheel switching locomotive with separate tender, 21x26" cylinders.
BALDWIN 55 ton 4-wheel saddle tank locomotive, 18x24" cylinders.
BALDWIN 40 ton 4-wheel sadd'e tank locomotives, 14x22" cylinders, three duplicates.
PORTER 36 ton 4-wheel saddle tank locomotives, 14x20" cylinders, two duplicates.
VULCAN 33 ton 4-wheel saddle tank locomotives, 13x18" cylinders, two duplicates.
VULCAN 21 ton 4-wheel saddle tank locomotive, 11x16" cylinders, six duplicates. 36" gauge.

Complete stock list on request.

BIRMINGHAM RAIL & LOCOMOTIVE COMPANY

Birmingham **Alabama**

KENNEDY VAN SAUN 6'0" AIR SWEPT TUBE MILL, with all parts and 12 ton chrome steel balls.
P & H Gasoline Shovel, model 208-A 1¼ yd. cap.; with all manganese bucket; caterpillar type; driven by Waukesha motor.
Telsmith gyratory crusher, No. 8CC; with manganese head.
Symons horizontal disc crushers. One 48"; and one 36".
Plymouth gasoline locomotives; 36" gauge; one 4 ton and one 7 ton availab'e.
Four ton side dump cars, new type. Five available.
Guy derrick; mast 12"x12x76'. Complete with American Hoist and Derrick Co. 3 drum hoist and swinger driven by 80 HP 3 ph., 60 c., 440 v. G.E. slip ring motor.
Sullivan air compress, class WH2; 12"x7½" 10"; with tank and motor.
Morris 6" sand pump, driven by 100 HP G.E. AC motor.
Cameron 5" centrifugal pump, LV No. 5, driven by 60 HP AC motor.
Cameron 4" centr'fugal pump, DV No. 4, driven by 20 HP AC motor.
Cameron high head pump, No. 3 HV, driven by 50 HP motor.
Gould 3" centrifugal pump, driven by 25 HP AC motor (Two).
And other miscellaneous quarry equipment.
ALL EQUIPMENT OFFERED FOR IMMEDIATE DISPOSAL

L. D. FIZER

132 North Third St. Philadelphia, Pa.

USED HOISTS

1—Lidgerwood 24" dia. will coil 1500 ft., ¾ rope, 50 HP motor.

1—Diamond Double drum 24" dia. will coil 1500 ft. ¾ rope 50 HP motor.

1—Lidgerwood 36" dia. will coil 2000 ft., ⅞ rope, 100 HP motor.

1—Flory 2-drum, 2-speed 10,000 lb. pull 200 FPM, 5,000 lb. pull 400 FPM, 100 HP.

Other hoists of varying sizes suitable for shafts, slopes, etc.

JONES MINING EQUIPMENT COMPANY

541 Wood St., Pittsburgh, Pa.

12" DREDGE PUMP

We have in stock, one Morris 12" Sand Pump, Manganese steel shell and one extra new Manganese shell, two extra liners, 12" valve and suction hose; pump on extended base with 300 HP, 2200 volt motor.

Sell cheap, with or without motor, excellent condition.

THE DENVER METAL & MACHINERY COMPANY

130 Larimer Street, Denver, Colorado

TA. 6178

EQUIPMENT FOR SALE CHEAP

1—Vulcan 40 ton Std. Ga. Saddle tank locomotive.
1—Marion 1 yd. Steam crane 40' boom on cats.
1—Marion 15 ton gas crane 40' boom.
1—Link-Belt K-2 crane 50' boom, 15 ton capacity.
1—Link-Belt K-44 shovel 50' boom, fairleads.
1—Lorain 75 B 1¼ yd. chain crowd shovel.
2—Plymouth 8 ton 36" Ga. locomotives.
2—Chicago Pneumatic Compressors, 590 cu. ft., 100H.P. G.E. Motor.
2—Worthington Compressors, 621 cu. ft., 75 H.P. motors.
1—Monarch 75 Caterpillar with bulldozer.
1—Sullivan 310' portable compressor.
1—Ingersoll-Rand pavement breaker.
6—Easton 4 yd. all steel 36" Ga. cars.
15—2 wheel concrete buckets.
1—Ransome 27 E Paver.
2—No. 116 Chicago Pneumatic Paving Breakers.
2—1 yd. Insley bottom dump concrete buckets.
1—1 yd. Steubner bottom dump concrete bucket.
1—1 yd. Kiesler rehandling bucket.
1—¾ yd. Browning clamshell bucket.
1—¾ yd. Blaw-Knox bucket.
1—Le Courtney 6" Cent. Pump, 40 H.P. motors.
1—Morris 8" dredge pump 150 HP. GE. mtr.
1—Morris 10" cent. pump 2250 GPM at 130' head.
1—Goulds 12" cent. pump 50 HP. GE. motor.
1—Thompson 6" self priming pump Waukesha motor.
2—Gardner Denver Sheeting Hammers.
2—Humdinger 6" self priming pumps, gas motor.
1—Humdinger 4" self priming pump.
1—Humdinger 2" self priming pump.
1—Domestic double diaphragm pump gas mtr.
1—GE. motor 200 HP. slipring.
2—No. 9 B 2 McKiernan-Terry Hammers.
3—No. 5 McKiernan-Terry Hammers.
3—No. 7 McKiernan-Terry Hammers.

HARRY C. LEWIS

325 Frelinghuysen Avenue Newark, N. J.

FOR SALE

35-ton McMyler Locomotive Crane
30-ton Whitcomb Gas. Locomotive
12-ton Whitcomb Gas Locomotive
8-ton Plymouth Gas Locomotive
6—5-Yd. 36" Gauge Dump Cars
½-yd. Byers Comb. Shovel-crane
1245 ft. Ing.-Rand Compressor
450 ft. Ing.-Rand Compressor
Barber Greene Bucket Loader 42B
100 Hp. Thomas Dragline Hoist
4½ x 6 Swinging Engine
6 Jackhammers and Sheeting Hammers
4—Pile Hammers, Nos. 3, 7, 9B2 McK
Crane Attachment for Marion 32 Shovel

J. T. WALSH

Brisbane Bldg., Buffalo, N. Y.

MISCELLANEOUS BARGAINS

Gasoline & Steam Shovels ⅜ to 2½ yard.
Electric Shovels 4, 6 & 8 yard.
2 yard Monighan & Bucyrus Draglines.
6 Yard Monighan Diesel-Elec. Dragline.
P & H No. 600 Dragline & Crane.
Steam, Gasoline & Electric Hoists.
Air Compressors, Belted, Gas, Steam.
Gyratory Crushers, Nos. 5, 6 & 8K.
Jaw & Roll Crushers, various sizes.
7 Ton Insley Stiff Leg Steel Derrick.
20 Ton American Guy Derricks.
Rotary Dryers, 5' x 32', 6' x 50', others.
36" Ga. Steam Locomotives 9 to 32 tons.
Std. Gauge Locomotives 25 to 64 tons.
68 Ton Shay Std. Ga. Locomotive.
Gasoline & Electric Locomotives, all sizes.
Clamshell Buckets, Owen ½, ¾, 1½, 2 & 2½ yard.
Dragline Buckets, Page ¾ and 1¼ yard.
2—10" Sand Pumps, Manganese lined.
Diesel Engines 25 to 600 HP with and without Generators.

Natural Gas & Steam Engines.
WIRE, PHONE OR WRITE.

MID-CONTINENT EQUIPMENT CO.
710 Eastgate St. Louis, Mo.

MUST SACRIFICE IMMEDIATELY

1—25 TON BALDWIN GASOLINE LOCOMOTIVE—Standard Gauge—Powered by 240 H.P. Pittsburgh 6 Cylinder Engine—COMPLETELY EQUIPPED—Electric Starter—Air Brakes—Batteries, Etc. Demonstration Can Be Arranged. PRICE $3500.00 F.O.B. Brooklyn, New York.
2—450 H.P. High Speed DIESEL ENGINES. PRICE $7500.00 Each.
1—2500 H.P. High Speed DIESEL ENGINE. PRICE $15,000.00.
1—100 H.P. High Speed DIESEL ENGINE PRICE $1000.00.
1—25 H.P. VICKERS DIESEL ENGINE. PRICE $500.00.
2—9 x 10 Three Drum LIDGERWOOD HOISTING ENGINES with 50 H.P. FOILERS. PRICE $800.00 Each.

BAKER & GREENBERG
574 Hamilton Avenue
Brooklyn, New York
South 8-8623

2—Barber-Greene 42-B loaders
1—Erie Gas Air 1¼ Yd. Shovel
1—32 Marion Steam Shovel
1—No. 8 Austin Crusher and Elevator
2—27 E Foote Pavers
1—Lakewood 2 screed Finisher 18' and 20' with drop screed for brick
1—Lakwood 20 ft. Subgrader
1—8 Ton Plymouth S.G. Locomotive
19—4 Yd. Steel Quarry Cars 48 in. Ga
3—New ⅜ Yd. ¾ Swing Gas Shovels
1—Osgood Gas Crawler Crane 1 Yd.

New and Used Equipment, tell us what you need.

THE T. J. LANE CO.
Springfield, Ohio

SPECIALS FOR SALE

Lorain Model 75-B gasoline crawler type 1¼ yard shovel; late model; rebuilt; A-1 condition.
P&H Model 300-B crawler type combination shovel and dragline; Buda Diesel Engine; ⅝ yard shovel; ½ yard drag; 40' boom; new 1935.
Brownhoist 20 ton capacity eight wheel type locomotive crane; 50' boom.
Eight 12 yard Western automatic air dump cars; vertical cylinders; steel draft sills.
Ten 6 yard Western standard gauge hand dump cars; steel draft sills.
Three 27 ton American four driver saddle tank steam locomotives.
Baldwin 80 ton 6 wheel switching type locomotive; cylinders 22"x26"; 37,600 lbs. tractive power; new 1922.
HAVE CONSIDERABLE OTHER EQUIPMENT IN STOCK REBUILT READY FOR DELIVERY

Southern Iron and Equipment Co.
PLANT & GEN. OFFICES, ATLANTA, GEORGIA

FOR RENT ON ROYALTY BASIS

30 acres of sand, gravel and stone—good market.

C. H. MANTELL
424 Atlantic St., Stamford, Conn.

CARS AND RAILS

14 cars like new, Easton 36" ga., 2 cu.yd. capacity, "V" shaped, all steel, heavy duty. Also all sections new and relaying rail and portable track, 12-lb. to 130-lb.

Wire or write for prices.

M. K. FRANK
480 Lexington Ave., New York City
450 Fourth Ave., Pittsburgh, Pa.

FOR SALE

2—75 B Lorain Gas-Shovel-Dragline.
1—20 ton Std. Ga. American Sad. Tank Steam Loco.
1—20 ton Brown Hoist Locomotive Crane.
1—20 ton Industrial Locomotive Crane.
1—50-B Bucyrus Steam Shovel—Dragline.
1—50-B Bucyrus Diesel Dragline.
Dump Cars, Locomotives, Shovels, Draglines.

CLAPP, RILEY & HALL EQUIPMENT CO.
14 N. Clinton St. Chicago, Ill.

Sauerman 1 yd. Drag Scraper hoist. Others ⅜ to 5 yd. Buckeye ⅜ yd. gas cat. Crane & Drag. Full revolving. Gas Cat. Crane, ¾ yd., 35-50' boom, full rev. $1250. Shovel Fronts—P&H, Northwest, L-B, etc. ¾ to 2 yd. Bucket Loaders—Haiss, Barber-Greene, & Link-Belt. Shovels—Gas Cat., ½-¾-1-1½-3-4 & 1 yd. $1000 up. Loco. Cranes—10 to 40 tons, inc. one 7 ton Gas. Crushers—Wms. No. 4 Jumbo 4' Cone, No. 6 & No. 5 Telsmith.
Monighan 3W Diesel Dragline, 75' boom. Real barg.
Northwest 1¾ yd. Crane & Dragline. Late type.

JAMES WOOD
53 West Jackson Blvd. - - Chicago, Ill.

FOR SALE

2—Universal shovels ⅜ yd. capacity, McCormick Deering Power.
1—¾ yd. Type C. Insley equipped as shovel and ditcher.
1—½ yd. General equipped as shovel and ditcher.
1—¾ yd. Osgood shovel.
The above in good condition and priced right.

JAMES SHELDON
Belmont & McKeen Sts. Easton, Pa.

2—¾ yd. Koehring Gas Crawler Cranes.
100, 200, 300, 600, 750 HP Diesel Units.
30 to 160 HP—"Caterpillar" Diesels.
2 & 3 Drum Hoists, Elec., Steam, Gas, Diesel.
Air Compressors, Motors, Generators, Transformers, Boilers, Locomotives, Cars, Rail, Etc.

MISSISSIPPI VALLEY EQUIPMENT CO.
501 Locust St. St. Louis, Mo.
Try Us Always—Whether Buying or Selling

FOR SALE

GAS—OIL—ELECTRIC LOCOMOTIVES

TWO—23½ ton, standard gauge (4 ft. 8½ in.) air brakes, automatic couplers, electric headlights. Highly efficient, economical. Strictly firstclass condition; practically good as new.

EQUITABLE EQUIPMENT CO., INC.
410 Camp Street New Orleans, La.

FOR SALE

1—1 yd. used Erie gas-air shovel. Location Minneapolis ..... $2500.
1—1¼ yd. used Osgood Heavy Duty gas shovel. Location Colorado ..... $2000.
1—Used Haiss Crawler Bucket Loader. Location Minneapolis ..... $1200.
1—Model 60 Diamond Duplex screening and crushing plant, rebuilt. Location Minneapolis.
Several very good Worthington Portable Air Compressors, 120 to 360 ft. displacement.

MINNEAPOLIS EQUIPMENT CO.
520 S. E. 2nd St. Minneapolis, Minn.

New Power Plant

250 KW Steam Erie Ball 4 Valve Engine.
Burk DC. 115/230—125/250 Volt Generator.

Condition—Brand New

90 ft. Steel Tuy Derrick, 80 ft. Boom.
150 KW. Steam Engine DC. Power Unit.

COOPER MACHINERY CO.
Youngstown, Ohio

SUBJECT TO PRIOR SALE

7" Newhouse Reduction Crusher with motor.
36" Allis-Chalmers Superior McCully Crusher.
4' Symons Cone Crusher. 24x36 Jaw Crusher.
265 Diamond Portable Crushing Plant.
100 & 200 HP Fairbanks engines and generators.
1¾ yd. Link-Belt K-55 Diesel Dragline, 75' Bm.
8" Ty. "B" Fuller-Kinyon Portable Cement Pump.
¾ yd. P & H Shovel-Dragline. Needs repairs.

ALEX McLEOD
7229 Rogers Ave. Chicago, Ill.

FOR SALE
DIESEL ENGINES

6 HP 1000 RPM Stover.
12 HP 1000 RPM Stover.
90 HP 450 RPM 4 cyl. Atlas.
160 HP 514 RPM 5 cyl. Atlas.

JOHN REINER & CO., INC.
29 Howard St., New York City
Canal 6-0286

FOR SALE OR LEASE

Immense Commercial Deposits of the following Metallics & Non-Metallics (all Open Quarry Mining). Low Grade—Gold and Silver Properties.
Lime, Calcium Carbonate.
Cement Materials.
Silica Quartz Sands.
Fire Clays & White Burning Ware Clays.
Brick Plant, 30,000 Cap.,
Close to R.R. and Markets, paved roads, cheap power and fuel. Reports by reputable Engineers & Chemists.
By owners. **Keegan Mining & Development Co., Wenatchee, Washington**

FOR SALE

Cummer 1800 yards asphalt plant which has been operating in New York area up to December 1st last. Dryer and mixing tower—$3500. **Address Box 204, Pit and Quarry Publications, 538 S. Clark St., Chicago, Ill.**

FOR SALE

Complete all electric 1½ yd. cableway washing plant and pit. Also one ¾ yd. cableway and washing plant complete gasoline power. Also one 6 cylinder 75 H.P. Diesel motor. If interested write for details.

RAY IRVING, R. R. No. 1, New Haven, Ind.

FOR SALE

3—24" Link-Belt Shaw Sand Classifiers
In Excellent Condition

TERRE HAUTE GRAVEL COMPANY
Terre Haute, Indiana

BUCKET ELEVATOR BELTS FOR SALE WITH BUCKETS

14" belt with 12" bucket.
12" belt with 10" bucket.
Long and short lengths, very low prices.
Also lot of BRAND NEW WIRE ROPE for sale, every size and length in stock.
Complete 36" BELT CONVEYOR FOR SALE.

TERRENCE P. WYNN
55 West 42nd St. New York, N. Y.

Frequently you will find items in Pit and Quarry that are of lasting value—items that you will want to refer to later.

Mark these items—then mark the page number of the item on the front cover. When you want to refer to them later on, the numbers on the front cover make reference easy.

Keep a library of copies of Pit and Quarry—they're valuable.

Try It!

"E. C. A. Rebuilt" Quarry & Gravel Plant Equipment

AIR COMPRESSORS

Portable and stationary, belt, with elec. or gas power, sizes from 21 cu. ft. to 1,000 cu. ft.

BINS

8—Bins: 2—Blaw Knox 118 ton; 1—Blaw Knox 117 ton with weigh batchers; 1—Butler 75 yd. with weigh batchers; 2—Johnson 76 yd. and 54 yd.; 2—Blaw Knox 72 ton with or without weigh batchers, all 2 compartment.

BUCKETS

1—4 yd. Hayward Class "G" Clamshell.
34—Williams, Blaw Knox, Owen Clamshell buckets, all sizes and types.
5—Dragline buckets: 1—Northwest 1¾ yd., 2—Page 1½ yd., 1—Omaha 1½ yd., 1—Blaw Knox 1 yd.

CARS

Large lot including std. ga. 6 and 12 yd. and 20 yd., 36-ga. 5 yd. and 24-ga. 1½ yd.
16—2 yd. 36 inch ga. Continental 2-way wood body dump cars.

CRANES and DRAGLINES

1—Koehring Model 501 dragline, Serial No. 1070, 45′ boom, 1¼ yd. bucket.
1—Northwest Model 104. Serial No. 2079, 45′ boom, 1¼-yd. bucket.
2—Northwest Model 105, Serial No. 756 and 2053, 40′ boom 1-yd. bucket.
1—Link Belt Model K-1 crane, shop No. 1024, 50′ boom, 1-yd. bucket.
1—Osgood heavy duty dragline, Serial No. 2069.
1—Industrial Brownhoist type CC, No. 5071, 30′ boom, ½-yd. bucket.
1—Byers Bearcat crane, Model 26, Ser. 30474, half circle swing, ½-yd. bucket.
1—Erie type B-2, Serial No. 3900 steam crane, 40′ boom, 1-yd. bucket.

CRANES (Locomotives)

5—Locomotive cranes; sta. ga. 30 and 25-tons; Ohio, Browning, American, Industrial.

CRUSHERS

1—Symons coarse cone crusher, size No. 5½, SU No. 521.
1—Set P & M crushing rolls, size 42"x16".
1—Allis-Chalmers, Style N, No. 6 gyratory No. 7755.
1—Allis-Chalmers Gates No. 5, Ser. 5331.
2—McCulley No. 3 gyratory.
1—Carroll 24"x36" jaw, manganese fitted.
1—Champion size No. 6, 12"x26", Ser. No. 1075.
1—Allis-Chalmers Blake type, size 10"x20", manganese fitted, Ser. No. 3163.
1—Champion size No. 4, 9"x15", jaw.

LOADERS

2—Barber Greene Model 42-A, self feeding loaders, cap. 1¾-yd. per minute.

DRILL (CORE)

1—Sullivan Model 21 Diamond core drill with hyd. feed and gasoline power. New, never used.

LOCOMOTIVES

32—Gasoline locomotives, from 20-ton to 2-ton, std. ga. 36" and 24" ga.
2—Plymouth std. ga. g s locomotives: 1—20 ton Model HL No. 2351; 1—12 ton Model JLB No. 2308.

PUMPS

4—Belt Driven Dredge pumps. 1—8" Morris; 1—6" Morris manganese; 1—6" Erie; 1—4" Morris.
2—Dayton Dowd 5" suct. 4" disc. centr. pumps V-belt drive to 100 HP Northwest oil engines, cap. 600 GPM at 450 ft. head.

SHOVELS

1—Lorraine 75-D 1¼-yd. shovel No. 4653 and with pull shovel attachment.
1—Osgood heavy duty Serial 2069, 1-yd. gas shovel.
3—Link Belt shovel attachments for K-55, K-44, K-42, K-38, K-2 machines.

EQUIPMENT CORPORATION OF AMERICA

PHILADELPHIA — P. O. Box 5471, Kingsessing Sta. — Phone Granite 7600
CHICAGO — 1160 S. Washtenaw Ave. — Phone Nevada 2400
PITTSBURGH — P. O. Box 933 — Phone Federal 2000

Jaw Crushers—2"x4" up to 66"x84".
Crushing Rolls—12"x12" up to 54"x24"—Gyratory Crushers
Ring Roll Mills—No. 0 and No. 1.
Swing Hammer Mill.
Rotary Fine Crushers—No. 1, No. 1½, No. 2.
Direct Heat Rotary Dryers—3½′x25′, 4′x30′, 5′x30′, 5½′x40′, 6′x50′, 7′x50′ and 8′x50′.
Semi-indirect heat Dryers—4′x30′, 4½′x26′, 5′x30′ and 8½′x75′.
Cement Kilns—3′ up to 8′ diameter.
Hardinge—Marcy & Fuller-Lehigh Mills.
Raymond Mills—No. 00, No. 0 and No. 1 and No. 5 roll.
Tube—Rod and Ball Mills—3′ to 8′ diameter.
Vibrating Screens.
New Dryers designed and built for all purposes.

W. P. HEINEKEN
95 Liberty St., N. Y. Tel.: Barclay 7-7298

FOR SALE

Five Switching Locomotives as above

Ready for Immediate delivery—Attractive price for quick sale
Quotations on Request

RAILWAY ACCESSORIES COMPANY, Times Star Tower, Cincinnati, Ohio

---

A. C. MOTORS—60 Cycle—3 PHASE

Hp.	Type	Speed
600	G. E. Sl. Rg.	257
600	G. E. Sl. Rg.	705
600	G. E. Syn.	257
600	Al. Ch. Syn.	450
500	G. E. Syn.	1200
500	West. Syn.	720
450	West. Sl. Rg.	875/700
400	West. Syn.	720
400	West. Sl. Rg.	514
400	G. E. Sl. Rg.	885
300	Al. Ch. Sl. Rg.	585
250	G. E. Sl. Rg.	257
250	West. Sl. Rg.	700
250	F.MorseSl.Rg.	1200
225	Elec.Mchy.Syn.	450
225	G. E. Sl. Rg.	1800
220	G. E. Syn.	600

MOTOR GENERATOR SETS

1500 KW. G.E. D.C. GEN., 275 V. comp'd interpole, conn. to: 2500 HP. Syn. Motor Type ATI. 11,431/6600 V., 360 RPM., 3 ph. 60 cy.
1000 KW., G.E. Type MPC, D.C. Gen., 250 V., conn. to: 1400 HP. synch. motor, 6600/2300 V., 514 RPM., 3 ph., 60 cy.

CENTRIFUGAL PUMPS

2500 GPM.—59′ hd. dir. con. to 150 HP. G.E. 1750 RPM. 440 V.-3 ph. 60 cy.

Above are a few of our stock items.

BELYEA CO., INC.
153 W. 18TH ST., NEW YORK CITY
REBUILT GUARANTEED

---

2 Jigger Selectro 3-Deck 3x8 Vibr. Screens.
Telsmith 3x8 Single-Deck Vibrating Screen.
9 Hummer Elect. Vibr. Screens, 1 and 2-Deck.
Hummer Screen Generators, 8 KVA 110-volts.
Centrifugal Electric Pump, 150 GPM 150′.
Goulds Centrifugal Pump, 1000 GPM 22 Hp.
Domestic Self-Priming Pump, 1000 GPM.
Morris Standard 8" Dredge Pump, no power.
F-M Belted Centrifugal 4x3" Pump, 375 GPM.
800 Belt Idlers and Pulleys, 16" to 36"-w.
14" Conveyor Equipment, 200′ 4-ply Belt.
Portable Flat Belt Conveyor, 14"x24′.
60′ Belt Elevator, 24" steel buckets.
60′ Belt Elevator, 36" steel buckets.
Haiss Digging Bucket Loader, on wheels.
Jeffrey No. 3 Comb. Jaw Crusher-Hammermill.
Farrel Jaw Crusher, 42" x 40", type E.
Kennedy 37 Gyratory Crusher, 75 Hp. motor.
Reliance 9"x16" Jaw Crusher.
Acme 10"x42" Jaw Crusher.
Revolving Stone Screen, 4′ dia. 20′ long.
Johnston 50 Hp. Loco. Boiler, 125 lb. skids.
Johnston 100 Hp. Loco. Boiler, 125 lb. skids.
Clamshell Mat'l. Buckets, ¾—1—1½ yards.
Mundy 2-Drum Hoist, 25 Hp. Slipring motor.
Mundy 2-Drum Hoist, 35 Hp. Buda Gas Engine.
Novo 40 Hp. Dragline 2-Drum Hoist.
Clyde 2-Drum Hoist, 100 Hp. Slipring motor.
I-R Belted XB Compressor, 446′.
I-R Belted XCB Compressor, 676′.
I-R Belted Vertical Compressor, 44′.
Schramm Compressor Unit, Tank and 15 Hp.

G. A. UNVERZAGT
15 Park Row New York City

1—Blaw-Knox bin, 3 compts., 150 yds., weigh batchers.
1—Butler bin, 3 compts., 100 yds., weigh batchers.
1—Batcher plant, Butler 125 yds., 3 compts., with weigh batch meters, cement bin, screw conveyor, etc.
1—Northwest No. 7 gas crane, 1¾ yds. cap. 70′ boom.
1—Lima comb. 1½ yd. shovel, 55′ crane boom.
1—Loraine comb. 1¼ yd. shovel and crane.
1—Loraine gas shovel, 1½ yd.
1—Byers gas 1 yd. Model 100 shovel and crane.
2—Osgood heavy duty steam, 1¼ yd. shovels.
1—Browning truck crane on Mack truck.
2—Locomotives, gas, 20 tons, 36" ga. Whitcomb.
1—Locomotive, gas, 20 tons, 36" ga. Vulcan.
1—Locomotive, gas, 4½ tons, 36" ga. Vulcan.
25—Cars, 5 yards, two way dumps, 36" ga.
10—Cars, 2 yds., steel V dump, 36" ga.
Conveyor belt systems, 20", 22", 30" complete.
50—Rock drills, DCR-23, X59, X49, S70, others.
10—Concrete breakers, pneumatic.
30—"BARRE" pneumatic carving tools, BL, CL, DL.
1—Bucket elevator, 32′.
1—Air compressor, 514 cfm, 14" x 12", electric drive.
1—Air compressor, 900 cfm, Deisel drive, Worthington.
1—Air compressor, 1,200 cfm, I. R., type PRE-2, elec.
1—Screen, Telsmith vibratory, 4′ x 12′, 5 h.p. motor.
5—Motor trucks, 5 yards, dump.
2—Derricks, steel stiff legs, 15 tons, cap. 100′ booms.
4—Derricks, steel guy, 7½ tons cap., 75′ booms.

Send us your inquiries for used equipment. We buy, sell or liquidate complete plants.
Richard P. Walsh Co., 30 Church St., New York City

We
- Sell
- Buy
- Rent
- Repair
- Exchange
- All Makes
- and Sizes

GREGORY HI-GRADE-REBUILT

Electric Motors, Pumps, Air Compressor Big Bargains. All Standard Makes.

Always Dependable Economical

Money-Back Guarantee

GREGORY ELEC. CO.
1603 S. Lincoln St., Chicago

SPLIT BUSHINGS

Machinery Spacer Tubes
Roller Bearing Sleeves

GIFFORD ENGINE COMPANY
Eaton Rapids, Mich.

CRUSHERS

1—36x42 FARREL 29-B Jaw Crusher
1—24x36 FARREL 14-B Jaw Crusher
Champion Jaw Crushers—Nos. 3, 4, 4½, 5 & 6
1—8 ft. International Dry Pan

JOHNSON AND HOEHLER, INC.
Lansdowne, Penna.

USED MACHINERY
REBUILT – GUARANTEED
CROWL EQUIPMENT CO.
BOX 543 NEW CASTLE, PA.

For Sale—A Good Time to Buy

Crusher Gyr. 7½ D and No. 8 Austin.
Dryers, Ruggles 8'x75', Buffalo 6'x30'.
Crushers, 2 Symons Cone 24", new '36.
Loco Crane, 35 ton Orton RR steam.
Draglines, Page 420, Sauerman 4 yd., both electric.
Crushers, Dixie Mogul 5024 and 5040.
Water softeners, 3 Permutut, 5 and 6 ft.
Shovels, 50B steam, Marion 480 and 37.
RR scales, Fairbanks, 125 ton, 56 ft., 4 sect.

A. V. KONSBERG
111 W. Jackson Blvd. Chicago, Ill.

LOCOMOTIVES

11x16, 21 ton, 36" gauge saddle tank ASME boilers, bargain price.

The Industrial Equipment Corp.
Warehouse P. O. Box 1647,
Carnegie, Pa. Pittsburgh, Pa.

10" H & B Manganese Dredging Pump also 400 H.P. Allis Chalmers Electric Motor for sale at a bargain.

WYLIE STEWART MACHINERY CO.
OKLAHOMA CITY, OKLAHOMA

FOR SALE
THREE STEEL TUGS
Two—used 112'x25'x10'3", 950 H.P. steam. First class condition.
One—new 48'6½"x11'8"x3'10½" draft with 85 H.P. Diesel engine, or 4'2" draft with 185 H.P. Diesel engine. Engine not yet installed. Purchaser to specify size.
EQUITABLE EQUIPMENT CO., INC.
410 Camp Street New Orleans, La.

We carry one of the largest stocks of good Used Machinery, Electric Motors, Generators and Compressors available in this territory. Every item guaranteed. Send us your inquiries. We assure you satisfaction and save you money.

FALK MACHINERY AND SUPPLY CO.,
New Address—18 Ward Street,
Rochester, New York

WIRE ROPE and CABLE

For Derricks—Cranes—Shovel Haulage, etc.
All sizes ⅜" to 1" Carried in Stock
Ask for Attractive Price List

DULIEN STEEL PRODUCTS, INC.
233 Broadway, New York City
534 First Av. S., Seattle, Wash.

RAILS "1 Ton or 1000"
NEW RAILS—5000 tons—All Sections—All Sizes.
RELAYING RAILS—25,000 tons—All Sections—All Sizes, practically as good as New.
ACCESSORIES—Every Track Accessory carried in stock—Angle and Splice Bars, Bolts, Nuts, Frogs, Switches, Tie Plates.
Buy from One Source—Save Time and Money.
'Phone, Write or Wire.
L. B. FOSTER COMPANY, Inc.
PITTSBURGH NEW YORK CHICAGO

FOR SALE
Lidgerwood 10x12 Three Drum Steam Hoist with or without 75 HP. Loco. Type Code Boiler. Both in very fine condition.
6—Western 7 yd. Crawler Wagons.
1—Plymouth 8 Ton, 36" Ga., Geared, No. 2667, Gasoline Locomotive.
1—O & S 22 Ton Locomotive Crane, 1929 model, 55' boom, very cheap.
1—Allis Chalmers Ten Ton Tractor, Model No. 75. No. 70599, fine condition, cheap.
1—Link Belt K-35 Crawler Crane, Gas, 50' boom, 1 yd. capy. **ROBERT H. BOYER**
303 Harrison Bldg. Philadelphia, Pa.

REBUILT ELECTRIC MOTORS
Over 10,000 items in stock for immediate delivery—Rochester, N. Y., or Toledo, Ohio, shipment. Rebuilt equipment sold with standard new guarantee. We buy used equipment—25 and 60 cycle—send us your offerings.
BERGER BROS. ELECTRIC MOTORS, INC.
1346 UNIVERSITY AVE., ROCHESTER, N. Y.
Phone Monroe 2094

"BELT CONVEYORS"

Troughing type belt Conveyors and Conveyor Belts Bought and Sold.

JOHN D. CRAWBUCK COMPANY
Empire Building, Pittsburgh, Pa.

ELECTRICAL MACHINERY

Motors and Generators, A.C. and D.C. for sale at attractive prices. New and Rebuilt. All fully guaranteed. Write for List and Prices.

V. M. NUSSBAUM & CO.
FORT WAYNE, IND.

FOR SALE
60"x84" JAW CRUSHERS — New and Used.
Gyratory Crushers—No. 3 to No. 21.
Jaw Crushers—9"x15" to 66"x84".
PULVERIZERS — SAND AND WATER PUMPS.
Steam and Oil Engine Sets, AC.-DC.
EVERYTHING FOR THE PIT AND QUARRY.
ROSS POWER EQUIPMENT CO.
Indianapolis Ind.

FOR SALE

One complete Sauerman Cableway outfit with 80 ft. steel mast with blocks and guy lines, etc., two speeds 80 H. P. electric hoist, Telsmith settling tanks, one yard bucket complete. This plant is in operation and is along Sauerman specification throughout and is in extra good shape.

JOHN JONES & SONS GRAVEL CO.
Indianapolis, Ind.

FOR SALE
Portable
Air Compressors
For Sale or Rent
Ingersoll Rand Two Stage Air Cooled.
Sizes 105 to 315.
Western Contractors Supply Co.
14 N. Clinton St. Chicago, Ill.

FOR SALE

200 HP G.E. synchronous motor, 25 cycle, 3 phase 440 v. 750 rpm.
50 HP West. CS motor, 60 cycle, 3 phase, 2200 volts, 1800 rpm.
65 HP G.E. Slipring 25 cycle, 3 phase, 440 volts, 1500 rpm.
ERIE ELECTRIC MOTOR REPAIR CO. INC.
124 Church Street, Buffalo, New York

SCALES

FAIRBANK—HOWE—COLUMBIA
Rebuilt Scales—Guaranteed
General Repairing
COLUMBIA SCALE CO.
2439 N. Crawford Ave., Chicago, Ill.

WANTED

One rotary cement kiln, 8, 8½ or 9 foot diameter, length 125' minimum, 150' maximum. Must be in first-class condition; location in middle west preferable. Give lowest cash price f.o.b. cars, naming shipping point, with full description. Address Box 212, Pit and Quarry Publications, 538 S. Clark St., Chicago, Illinois.

WANTED

Portable Crushing and Screening Plant. Pioneer 34-V preferred, also 2 to 3 thousand pound asphalt plant. State full particulars, condition and price.

UNION EQUIPMENT CO.
Redford Station Detroit, Mich.

WANTED

One Set Batch Bins.
One Set Batch Scales.

Lincoln Crushed Stone Co.
Joliet, Illinois

WANTED

Shovel front for P & H model 400 crane. Please state condition, price and if complete with planetary system.

JAMES MARIO & SON, Inc.
44 Lincoln Ave. Bridgeport, Conn.

Royal E. Burnham

Attorney at Law

•

Patent and Trade-Mark Causes

•

511 Eleventh Street, N. W.
WASHINGTON, D. C.

WE LOOK INTO THE EARTH

By using Diamond Core Drills We drill for Limestone, Gypsum, Talc. Fire Clay. Coal, and all other minerals.

PENNSYLVANIA DRILLING CO.
Drilling Contractors
Pittsburgh, Pa.

J. C. HOFFMAN, Pres. L. H. HOFFMAN, Treas.
DIAMOND CORE DRILLING
HOFFMAN BROS. DRILLING COMPANY
PUNXSUTAWNEY, PA.
We drill for any mineral. We have more than forty steam, electric and gasoline drills, adapted for any job. Satisfactory cores guaranteed. Our prices are right.
Established 1902 - - - - - Telephone No. 382

POSITION WANTED

By experienced Sales Engineer in selling contracting and quarry equipment. Can furnish best of references. Address Box 208, Pit and Quarry Publications, 538 S. Clark Street, Chicago, Illinois.

FOREMEN WANTED

Two foremen for new sand and gravel washing and crushing plants. All details first letter as to age and experience, stating type of field loading equipment and washing plant machinery experience. Iowa location. Address Box 210, Pit and Quarry Publications, 538 S. Clark Street, Chicago, Illinois.

WANTED TO BUY

Small used ball mill, capacity approximately one-half ton or more per hour and small rotary dryer. Address Box No. 206, Pit and Quarry Publications, 538 South Clark Street, Chicago, Illinois.

Wanted:—

New Products to Sell
New Products to Manufacture

Frequently equipment manufacturers and distributors have asked us to find new products which they can acquire. In some cases they desire logical products to sell along with their own—as a means of lowering their sales costs by expanding volume. In other cases they want to manufacture new products that are adapted to their production facilities; with or without assuming sales responsibilities. If you have (or want) new products to sell or to manufacture we might help you. Send full particulars to

Pit and Quarry Publications,
538 S. Clark St., Chicago

For Sale

2 — 26'0"x76'0"x5'0" — 15" Steel Dredge Boats, complete, equipped with 60'0" Str. Steel Ladder, Rotary Cutter, 15" Amsco Manganese Dredge Pump, Marion 5 Drum Electric Hoist, Marine Cable, solenoid brake, grids, priming pump, 2 — 60'0" spuds, overhead lever bank, 20'0" A Frame, 300 and 350 HP Electric Motors 2200 Volt, Manganese Stone Box, 15" Manganese Elbows, long and short radius, and complete in every detail. Additional 35'0" Structural Steel Ladder.

LOCATED CENTRAL INDIANA

ELWOOD SALES & MFG. CO. Lafayette, Indiana

REBUILT LIKE NEW

12" AMSCO Sand and Gravel Pump.
4'6" Dia. x 20' Rotary Sand Dryer.
368 CFM—1-R Class ER-1 Compressor.
330 CFM Portable Gasoline Compressor.
30" x 50' Steel Apron Conveyor.
30' Center 12" Buckets Elevator, Steel Casing.
120 CFM Schramm Semi-portable Compressor.
42" x 48" Jeffrey Hammermill, Ball Bearings.
36" x 30", 42" x 42", 61" x 42" Ring Roll Crushers.
2' Symons Cone Crusher.
36" x 18" Dbl. Roll Crusher.

Send for complete list.

MACHINERY SALES CORP. OF AMERICA

565 W. Washington St., Chicago, Ill.

We repair Diesel & Gas. Engs., Compressors, etc.

An unusual offering!

6½ yard MINING or STRIPPING SHOVEL

Bucyrus 320-B 2300 volt, 3 ph. 60 cycle, A.C.—250 volt D.C. Ward-Leonard control. 90 ft. boom and 40 ft. dipper stick. Built 1925 and used only two years. Very good condition.

Located near Madisonville, Ky. Part cash terms if necessary.

IRON & STEEL PRODUCTS, INC.

Railway Exchange, Chicago, Ill.

Phone: HARrison 0163 *"Anything so long as it contains IRON or STEEL"*

FOR SALE

Gyratory Crushers: No. 6, No. 5 and 10" Superior McCully, No. 5 Austin, No. 4 Style N, No. 3 and No. 2 Gates.

Symons Horizontal Disc Crushers: 48" and 24".

Jaw Crusher: 6x14, 8x16, 10x20, 16x24, 8x36, 11x36, 24x36.

Gas and Electric Motors: 1 HP to 200 HP.

Hoists: Clyde 2 drum for 2 yd. drag scraper, Thomas 2 drum for 1½ yd. drag scraper, several smaller.

Insley 5 ton all steel derrick, 80' boom, 90' mast, 2—55' guy struts, 16' bull wheel. 7x10 three drum hoist engine. 3x4 swing engine.

4 Complete gravel washing plants.

LIPPMANN ENGINEERING WORKS

4603 W. Mitchell St. Milwaukee, Wis.

Gyratory Crushers: Nos. 5K, 6K & 8K Gates, 25 McCully, 26 & 10 Austin, 6BH Traylor.
Jaw Crushers: 9x16 up to 60x84.
Rotary Dryers: 4½x30, 5x50, 6x55.
Smooth Face Crushing Rolls: 54x24, 42x24, 36x16, 40x15, 30x16, 20x14, 16x10.
60 Ft. Guy Derrick Handling Outfit with 60 HP Gas Hoist.
1 yd. Sauerman Elec. Slackline Outfit.
1¼ & ⅜ yd Marion Elec. Cat. Shovels, A.C.
Tube Mills, 7x22, 7x10, 6½x16, 5½x20, 5x22, 5x18.
21½ Sturtevant Ring Roll Mill.
30" Griffin Mill.
250 Ton Hydraulic Forcing Press.
Pennsylvania 8-7 Hammer Mill.
Williams #3 Helix Seal & Universal Mills.
No. 0 Raymond Pulverizer.
Rotary Kilns, 8x110 & 6x60.

TIDEWATER EQUIPMENT & MACHINERY CORP.

875 Sixth Ave. New York, N. Y.

1—30" Kennedy Gyr. Crusher, 2 30"x115" openings.
1—Ottumwa Hoist, 42"x50" main drum, new.
1—60 HP Diesel Engine & Lidgerwood Hoist, new.
1—Marion Steam Shovel-Crane, ¾ yd., 47' boom.
1—Erie B Steam Shovel, ¾ yd.
2—Portable Air Compressors; 110 & 240 cfm.
3—Air Compressors; 257, 530 & 920 cfm.
1—No. 50 Drill Sharpener.
1—7½K Allis Chalmers Gyratory Crusher.
1—No. 37 Kennedy Gearless Crusher.
1—18x36 McLanahan Single Roll Crusher.
6—Jaw Crushers; 24x12; 20x12; 20x10; 18x9.
2—Gas Locomotives, 40" ga., Milwaukee.
2—80 HP Titusville Return Tubular Boilers.
1—125 HP Farquhar Portable Boiler.
1—27E Multifoote Road Paver; almost new.
1—40 HP GE Motor, 220 V., 1145 RPM.
1—Portable Conveyor; 11" belt, 20' ctrs.
1—Rotary Screen, 36"x20'.
2—Wet Sand Mills & Screw Washers.
16—12 yd. Koppel Cars; air dump, std. ga.
Complete Gas Producer Plant, 2 units, with coal handling equip., boilers, etc.; new.

S. B. MAXIMON

Box 543 Phone 2-2890

Altoona, Pa.

FOR SALE

440 Volt Used Motors. Complete with Control Equipment. In Good Condition.

1— 3 HP.—1735 RPM.
1—7½ HP.—1740 RPM.
1— 10 HP.— 860 RPM.
1— 15 HP.—1120 RPM.
1— 15 HP.—1150 RPM.
2— 25 HP.—1750 RPM.
1— 40 HP.— 900 RPM.

1—200 HP.—Variable speed complete with pulley and belt.

Repossessed Eagle "Swintek" Screen Nozzle Ladders

1— 8 in.—25 ft., used.
1—10 in.—50 ft., used.
1—10 in.—35 ft., new.

Also flexible hose couplings and fittings for 8 in. and 10 in. pipe line.

EAGLE IRON WORKS

129 Holcomb Ave. Des Moines, Iowa

FOR SALE

Completely rebuilt 1-yd. P & H Model 206 gas crane, 40' boom, 2 propelling speeds, good as new; $3650.
Reconditioned late model 500 1-yd. P & H gas shovel; $5500.
Heavy duty ½-yd. Model 200-A, P & H gas shovel, being completely rebuilt, March del'y.; $4250.
New, but not latest model, 10-ton ¾-yd. Orton gas crawler crane, 40' boom, guaranteed; 25% price reduction to $5875.
2—Unit-Fordson ⅜ yd. ¾ swing power shovels, $850-$1300.
American 7x10 steam hoist and 1½-yd. drag scraper; $475.
Northwest 1-yd. 105 comb. shovel-dragline-hoe, 45' boom; $4750.
Plymouth 8-ton std. gauge loco.; $1250.
Model 6 Northwest 1½-yd. shovel-dragline; $8500.

H. Y. SMITH CO.

828 Broadway - - - Milwaukee, Wisconsin

SHOVELS STEAM

2—1¼ yd. OSGOOD
CATERPILLAR SHOVELS

Guaranteed Shop Reconditioned

ANY DEMONSTRATION

Boilers passed for High Pressures and are NATIONAL BD. A.S.M.E. MASS. and OHIO Std.

— — PRICED RIGHT TO MOVE — —

R. P. Walsh Equipment Company

827 E. 9th Street. N. Y. C.

FOR SALE

2—3½ ton 36" ga. Plymouth Gas Locomotives.
12—5 yd. 36" ga. Western Dump Cars.
6—2 yd. 36" ga. Koppel Steel V-shape Cars.
4—1½ yd. 36" ga. Insley V-shape Dump Cars.
23—12 yd. Western 2-way Air or Hand Dump Cars
4—50 ton 41 ft. Steel Flat Cars.
26—50 ton Center Dump Gondola Cars.
2—40 ton Baldwin S.T. Locomotives, 14x22 cyls.
Rails—First-Class Relaying Rails, 60, 70, 80, 85, 90 and 100 Lb. Rails and Bars, Tie Plates, Spikes, Switches.

HYMAN-MICHAELS CO.

20 N. Wacker Dr. Bldg. Railway Exchange Bldg.

CHICAGO, ILL. ST. LOUIS, MO.

FOR SALE

Polysius Size 14 Zet Crusher

12" x 12" x 10"

50 Tons per Hour

With G. E. 100 H.P. Supersynchronous Motor for Operating Crusher.

Also 1—100 H.P. Vulcan No. 86 Single Drum Geared Electric Hoist, Completely Equipped with 100 H.P. G. E. Motor.

This Equipment Has NEVER Been Used.

Address Box 202, Pit and Quarry Publications, 538 S. Clark St., Chicago, Ill.

FOR SALE

One Blake type, 48"x60" self-aligning Traylor crusher; complete with 500 h.p. synchronous motor. This crusher has never been assembled and is an excellent bargain at $5500.

Four Kent mills in excellent condition; 223,000 used cement bags; one-half mile old gauge industrial track.

Above can be inspected at Hartshorne, Oklahoma. Complete information upon request. Address P. O. Box 3046, Houston, Texas.

Index to Advertisers

Aeroil Burner Co. 92
*Allen Sherman Hoff Co. 111
*Allis-Chalmers Mfg. Co. 24
American Cable Co. ..... Inside Back Cover
American Manganese Steel Co. 103
*American Pulverizer Co. 89
Atlantic Steel Co. 86
Audubon Wire Cloth Corp. 111
*Austin-Western Road Machy. Co. 21

Bacon, Inc., Earle C. 88
*Baldwin Locomotive Works 113
*Bartlett & Snow Co., C. O. 111
*Bay City Shovels, Inc. 39
Birmingham Rail & Locomotive Co. 115
*Blaw-Knox Co. 18
Bonnot Co. 109
Broadcast Section 115-119
*Bucyrus-Erie Co. 6
Buffalo Wire Works Co. 96
Burnham, Royal E. 118

Calcium Chloride Ass'n 32
Carnegie-Illinois Steel Corp. 28-41
Caterpillar Tractor Co. 15
Chain Belt Co. 9
*Chicago Bridge & Iron Co. 5
Chicago Perforating Co. 94
Chicago Steel Fdry. Co. 95
*Cincinnati Rubber Mfg. Co. 114
Cleveland Rock Drill Co. 95
Cleveland Wire Cloth & Mfg. Co. 106
*Consolidated Products Co. 115
Cover, H. S. 89
Cross Engr. Co. 114

*Deister Concentrator Co. 105
*Deister Machine Co. 97
Dempster Bros., Inc. 112
Denver Metal & Machy. Co. 115
*Dixie Machy. Mfg. Co. 91
Dunn Mfg. Co., W. E. 99

*Eagle Iron Works 101
Elwood Sales & Mfg. Co. 119
*Ensign-Bickford Co. 30
Equipment Corporation of America 117
Erie Pump & Engine Works 111

*Farquhar Co., A. B. 106
Fizer, L. D. 115
Flexible Steel Lacing Co. 110
*Fuller Co. 2

Gay, Rubert M. 103
*General Electric Co. 22-23
General Motors Corp. 27
Goodyear Tire & Rubber Co. 42
*Gruendler Crusher & Pulv. Co. 85

Haiss Mfg. Co., Geo. 86
*Hardinge Co. 107
*Harnischfeger Corp. 35
*Hendrick Mfg. Co. 112
Hetherington & Berner, Inc. 120
Hewitt Rubber Corp. 44
Hoffman Bros. Drilling Co. 118

Industrial Machy. Co. 115
*Ingersoll Rand Co. ..... Back Cover
Iowa Mfg. Co. 14
Iron & Steel Products, Inc. 119
I. T. E. Circuit Breaker Co. 96

Jaeger Machine Co. 7
*Jeffrey Mfg. Co. 12-13-114
Jones Mining Equipment Co. 115

Kansas City Hay Press Co. 114
*Kennedy-Van Saun Mfg. & Engr. Corp. 113
Kern Co., Fred T. 112
*Koehring Co. 17

Leschen & Sons Rope Co., A. 90
Lewis, Harry C. 115
Lewiston Foundry & Machine Co. 112
Licensees Under Preformed Wire Rope Patents 20
*Link-Belt Co. 1-108
Ludlow-Saylor Wire Co. 114

Manganese Steel Forge Co. 111
McLanahan & Stone Corp. 111
Merrick Scale Mfg. Co. 108
*Morris Machine Works 112

National Wire Cloth Co. 88
New Holland Machine Co. 101
*Nordberg Mfg. Co. 31
Northwest Engr. Co. 29

Owen Bucket Co. 120

*Page Engr. Co. 3-93
Patterson Fdry. & Machine Co. ..... Inside Front Cover
Pennsylvania Drilling Co. 118
Philadelphia Hotel 112
*Portable Machy. Co. 106
*Productive Equipment Corp. 112

Railway Accessories Co. 117
*Raymond Bros. Impact Pulv. Co. 34
Redmont Hotel 108
Republic Rubber Co. 33
*Robins Conveying Belt Co. 111
*Roebling's Sons Co., John A. 38

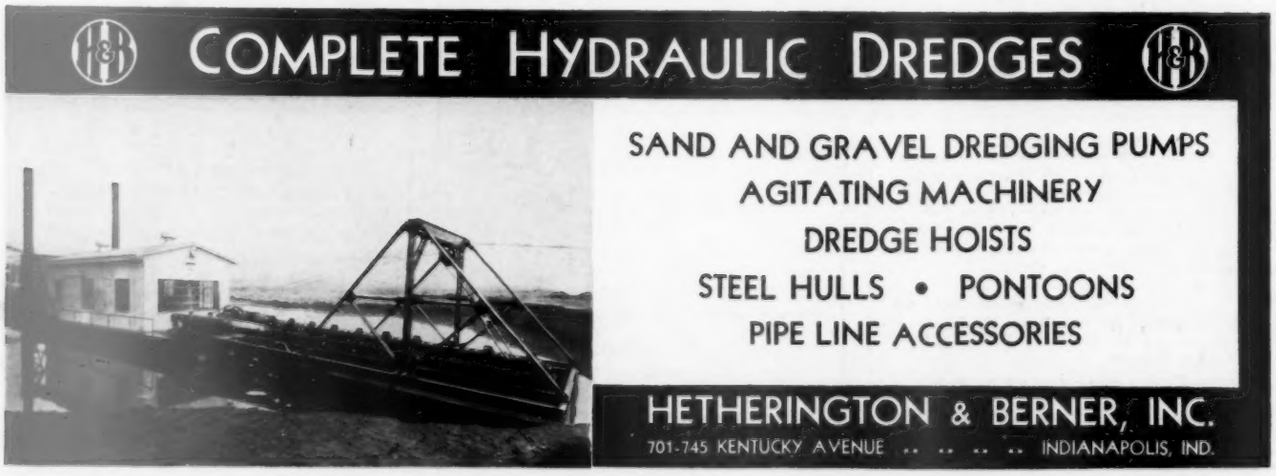
*Sauerman Bros., Inc. 111
Simplicity Engr. Co. 110
Smith Co., S. Morgan 19
Smith Engr. Works 11
Stulz-Sickles Co. 107
Sturtevant Mill Co. 8
Symons Bros. Development Co. 109

Taylor Forge & Pipe Work 87
Taylor-Wharton Iron & Steel Co. 10
Timken Roller Bearing Co. 4
Toro Mfg. Corp. 106
*Traylor Engr. & Mfg. Co. 99
*Tyler Co., W. S. 112

United States Steel 28-41
United Welding Co. 91
Universal Concrete Pipe Co. 96
Universal Road Machy. Co. 103
Unverzagt, G. A. 117

Walsh Co., Richard P. 117
*Warren Bros. Roads Co. 109
Welch, F. M., Engr. Service 114
Wellman Engr. Co. 111
*Western Precipitation Corp. 108
*Whitcomb Locomotive Co. 113
*Wickwire Spencer Steel Co. 25
*Williams Patent Crusher & Pulverizer Co. 105
*Williamsport Wire Rope Co. 26
Wilson, K. R. 88
Worthington Pump & Machy. Corp. 37

***See also information in the 1936 Pit and Quarry HANDBOOK**


COMPLETE HYDRAULIC DREDGES
SAND AND GRAVEL DREDGING PUMPS
AGITATING MACHINERY
DREDGE HOISTS
STEEL HULLS • PONTOONS
PIPE LINE ACCESSORIES
HETHERINGTON & BERNER, INC.
701-745 KENTUCKY AVENUE .. .. INDIANAPOLIS, IND.

"SAY!..."

FROM THE STANDPOINT OF COMPARATIVE SERVICE TRU·LAY PREFORMED IS GROSSLY UNDER-PRICED"

"I'll trade Two-Bits for a Dollar.. ANY DAY!"

GREEN SIGNIFIES SAFETY

"Of course, TRU-LAY Preformed costs a little more. But it is worth far more than the slight differential in price. . . . Because it not only lasts longer but keeps your machine operating with fewer interruptions—is safer for the men to handle—is faster and better all around.

"Initial cost should never be the determining factor in the purchase of anything. Preforming has made as much difference in wire rope as there always has been in shoes. A little more expensive shoe will invariably fit your feet better and wear longer. So it is with wire rope. TRU-LAY costs a little more because it has been preformed. But it fits into your job better—and lasts *much* longer. When I pay two-bits more for TRU-LAY Preformed, I know I am going to get an extra dollar's worth of service. That's why I stick to TRU-LAY—and *have,* ever since it was introduced back in 1924. American Cable is the pioneer in the development and perfection of preformed wire rope."

AMERICAN CABLE DIVISION
WILKES-BARRE, PENNSYLVANIA
AMERICAN CHAIN & CABLE COMPANY, INC.
District Offices: Atlanta, Chicago, Detroit, Denver, New York, Philadelphia, Pittsburgh, Houston, San Francisco
In Business for Your Safety

BUY ACCO QUALITY

A FEW OF THE 137 AMERICAN CHAIN & CABLE INDUSTRIAL PRODUCTS

AMERICAN CHAIN DIVISION
(DOMINION CHAIN COMPANY, Ltd., in Canada)
Weed Tire Chains • Welded and Weldless Chain • Malleable Castings • Railroad Specialties

AMERICAN CABLE DIVISION
Tru-Lay Preformed Wire Rope • Tru-Loc Processed Fittings • Crescent Brand Wire Rope Tru-Stop Brakes

ANDREW C. CAMPBELL DIVISION
Abrasive Cutting Machines • Floformers Special Machinery • Nibbling Machines

FORD CHAIN BLOCK DIVISION
Chain Hoists • Trolleys

HIGHLAND IRON & STEEL DIVISION
Wrought Iron Bars and Shapes

MANLEY MANUFACTURING DIVISION
Automotive Service Station Equipment

OWEN SILENT SPRING COMPANY, INC.
Owen Cushion and Mattress Spring Centers

PAGE STEEL AND WIRE DIVISION
Page Fence • Wire and Rod Products Traffic Tape • Welding Wire

READING-PRATT & CADY DIVISION
Valves • Electric Steel Fittings

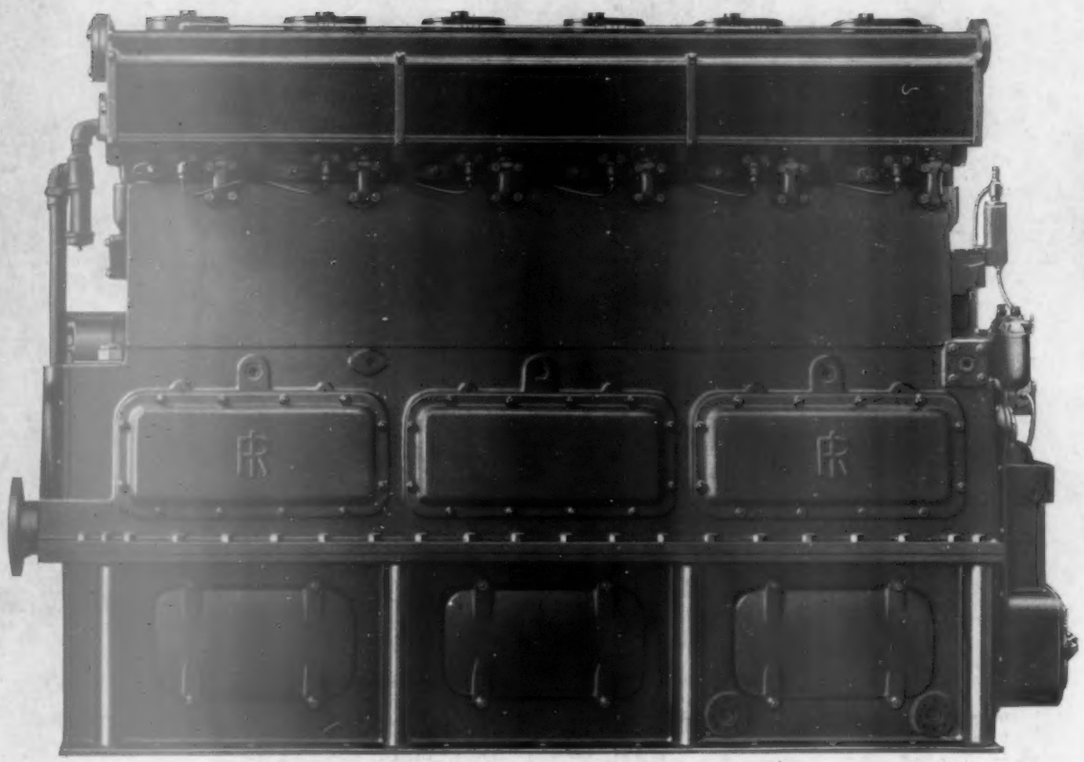
READING STEEL CASTING DIVISION
(OF READING-PRATT & CADY DIVISION)
Electric Steel Castings, Rough or Machined

WRIGHT MANUFACTURING DIVISION
Chain Hoists • Electric Hoists and Cranes

TRU·LAY *Preformed* WIRE ROPE

ALL AMERICAN CABLE DIVISION ROPES MADE OF IMPROVED PLOW STEEL ARE IDENTIFIED BY THE EMERALD STRAND

MORE EFFICIENT POWER TRANSMISSION



with
TYPE "S" DIESELS

A few of the many advantages of Type S Diesels:

1. MODERN DESIGN
2. LOWER FUEL CONSUMPTION
3. LOWER INSTALLATION COSTS
4. ✓ MORE EFFICIENT POWER TRANSMISSION
5. INEXPENSIVE TO MAINTAIN
6. A THOROUGHLY PROVED ENGINE

INGERSOLL-RAND Type S Diesels operate at speeds comparable to other modern mechanical and electrical equipment. This makes it possible to direct-connect, belt or gear these machines to generators, pumps, etc. with a minimum of transmission losses.

Electric generators for Type S engines are more efficient and less costly than the generators required for slow-speed engines.

These and other advantages of modern Type S engines make them ideal for a wide variety of applications. They are furnished in 3, 4, 5, 6 and 8-cylinder sizes for loads from 150 to 460 hp.

Ask our engineers for further data.

Atlanta
Birmingham
Boston
Buffalo
Butte
Chicago
Cleveland
Dallas
Denver
Detroit
Duluth
El Paso
Hartford
Houston
Knoxville

Ingersoll-Rand

11 BROADWAY, NEW YORK CITY

401-7

Los Angeles
Newark
New York
Philadelphia
Picher
Pittsburgh
Pottsville
Salt Lake City
San Francisco
Scranton
Seattle
St. Louis
Tulsa
Washington